City of Torrance Police Department Urban Coyote Management Program: Review & Analysis

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1. Executive Summary

The presence of urban coyotes in Torrance, California is a controversial topic among Torrance residents and bordering communities. In January 2017, the Torrance Police Department solicited assistance from graduate students at the University of Southern California, Sol Price School of Public Policy, to assess the issue. (For reference purposes, the graduate student research team is referred to as the "Project Team" in the text that follows.)

This report details the Project Team's research regarding the factors that may have affected urban coyote activity within Torrance, CA and the practices that may effectively address this activity. The Project Team provides recommendations and implementation strategies to the Torrance Police Department in hopes of enhancing the department's overall effectiveness in its urban coyote management efforts. By conducting expert interviews, a detailed academic literature review, an analysis of city case studies, and an examination of coyote reporting, the Project Team discovered several key factors believed to have influenced coyote activity in Torrance, CA and a list of common municipal practices that have been used to respond to coyote activity in Southern California's urban areas. These common factors include: 1) human behavior, 2) natural coyote behavior, and 3) the environment. The common practices identified include: 1) education, 2) hazing, 3) targeted removals, 4) enforcement of wildlife feeding, 5) tracking, and 6) management plans. Upon careful analysis of scientific data and anecdotal information, the Project Team determined that enhancing education and outreach, hiring a civilian program manager, and enforcing wildlife feeding consequences would be the most effective strategies to enhance the City of Torrance's urban coyote management program.

2. Torrance Police Department & Issue Background

The Torrance Police Department (Torrance PD) has proudly served the Torrance community for over 80 years. The department employs 228 sworn police officers and 100 civilians. It is led by Chief Mark Matsuda, and is supported by a Deputy Chief and four Captains ("About TPD," 2014). Torrance PD seeks "to preserve public safety and quality of life within the City of Torrance, to respond effectively to the changing needs of the community, and to promote mutual respect between the Police Department and the people [it] serve[s]. The Department's primary concern is community safety" ("About TPD," 2014).

Since 2015, Torrance has experienced an increase in reported urban coyote activity within city boundaries. Whether through sightings or attacks, this presence has become a contentious topic among residents due to the various response mechanisms utilized by the City of Torrance. With a heightened concern for the safety of both Torrance residents and their pets, Torrance PD was tasked with managing the perceived increase in urban coyotes in the community. In order to address this issue, Torrance PD assembled a Coyote Management Team under the direction of the Torrance PD Special Operations Bureau Commanding Officer, Captain Martin Vukotic. The team currently meets every other Tuesday at 10:00 AM to discuss the urban coyote problems facing the Torrance community and to discuss ways in which Torrance PD and Torrance residents can effectively respond to coyotes in the area. As stated on the Torrance PD website, as of January 17, 2017, Torrance PD's Coyote Management Program has expended $15,904.28 of its Torrance City Council approved $25,000 budget for the 2016-2017 Fiscal Year

("Living with Urban Coyotes: Coyote Program Financial Information," 2017). Overall, the department has expended a total of $107,097.19 towards these efforts ("Living with Urban Coyotes: Coyote Program Financial Information," 2017). While Torrance PD manages most concerns regarding coyotes, the Torrance Animal Control program identifies injured coyotes and treats said animals when necessary. Torrance PD has assumed the lead role in managing urban coyote issues as the department is able to quickly respond to coyotes and human-coyote interactions. Furthermore, Torrance PD has contracted a trapper and veterinarian to remove and/or euthanize coyotes when trapped. While this method is used to address coyotes identified as problematic, it is often a last resort due to the controversial response from the Torrance community and wildlife activists.

Torrance PD has made strategic efforts to educate the community about urban coyotes, providing detailed precautions residents can take to deter coyotes. With the creation of the Torrance PD's Urban Coyote Management Plan, an outreach strategy and education approach were developed. For instance, Torrance PD deployed bike patrols to targeted areas with a high coyote presence in order to inform residents about coyotes and how residents may safely respond if they encounter a coyote (i.e., through hazing methods). In addition, the department previously contracted a vendor to distribute urban coyote informational brochures via door hangers, while the City created flyers, signs, water bill inserts, and children's coloring books as educational tools for the Torrance community. The information included in these educational materials was assembled based upon information gathered from the California Department of Fish and Wildlife, as well as additional experts who have experience with urban coyotes. Furthermore, Torrance PD has collected and published statistical data regarding coyote sightings and coyote attacks in Torrance, and the department continues to refine the ways in which it collects and tracks this data.

3. Research Purpose

The purpose of the Project Team's research was to aid Torrance PD in its efforts to protect the well-being of Torrance residents, while also maintaining the safety and security of wildlife. An increased concern for public safety propelled the Project Team's study, as it has been locally perceived that residents' quality of life has significantly deteriorated due to urban coyote activity. The safety of pets and children has led to continued vigilance and constant behavioral adaptation by community members in order to accommodate the city's urban coyote presence. Residents have pushed the Torrance City Council and Torrance PD to implement more extreme measures to resolve urban coyote issues. However, Torrance PD must also address the concerns of wildlife activists that reinforce the importance of establishing coexistence and not extermination. While this matter is of concern to the Torrance community, it is not a unique concern to Southern California as a region. Urban coyote conflicts have impacted neighboring cities in a variety of ways. While some individuals argue that certain municipalities are more affected by urban coyotes than others, the prevalence of coyote conflicts in Southern California as a whole calls for regional policy and program reform. This is another component that motivated the Project Team's study.

4. Research Question

In order to best assist Torrance PD, the Project Team established the following research question:

What factors (human, environmental, etc.) have caused an increase in coyote activity in Torrance, CA, and what practices may effectively address this increase?

To provide an answer to this question, one must better understand the problem. A common perception in the community is that there has been an increase in urban coyote activity (i.e., coyote sightings and aggressive coyote behavior, including bites and attacks). The Project Team notes that the frequency of coyote sightings may not be scientifically attributed to an increase in coyote numbers, because extensive collar tracking has yet to be established within the city to determine if coyote reports can be connected to one or multiple coyotes. By conducting research around the factors believed to impact coyote activity, the Project Team was able to propose ways to potentially address these factors. The following sub-questions were also explored by the Project Team during initial research:

1. *Has climate change been a factor? How do rainfall totals affect coyotes?*
2. *Is construction affecting coyotes?*
3. *Are there common practices established to address spikes in urban coyote/wildlife activity?*

While research was not limited to these sub-questions, they provided further guidance to the Project Team when conducting the overall research study. Climate was initially a concern due to the recent drought that occurred in California. Additionally, construction was explored due to its speculated impact on local wildlife. Early conjectures suggested that city construction projects either attracted coyotes by providing them with shelter and food, or disturbed coyote habitats, pushing coyotes to new areas. Finally, common response practices were of interest to the Project Team due to the potential that they could either provide Torrance PD with possible enhancements to its urban coyote management approach, or support the measures Torrance PD has already executed.

Note: Due to the controversial nature of this issue, anonymity was requested from various interviewed experts. In order to accommodate these requests, the Project Team determined it was best to create a "Works Consulted" page that acknowledged expert participation in the study, but also respected expert anonymity by not attributing direct quotations to listed interviewees.

5. Context of Urban Coyotes in California

Coyote Ecology

Coyotes (*canis latrans*) have inhabited the Southern California region since the end of the last ice age extinction. The presence of coyotes in the United States was possibly documented by early European colonists as "wolves," and coyotes were mainly confined to the plains and western half of the continent at the time. As American settlements pushed farther and farther westward, coyote ranges expanded. Coyotes are now found across the North American continent,

all the way to the southern border of Panama (Gehrt, 2007).

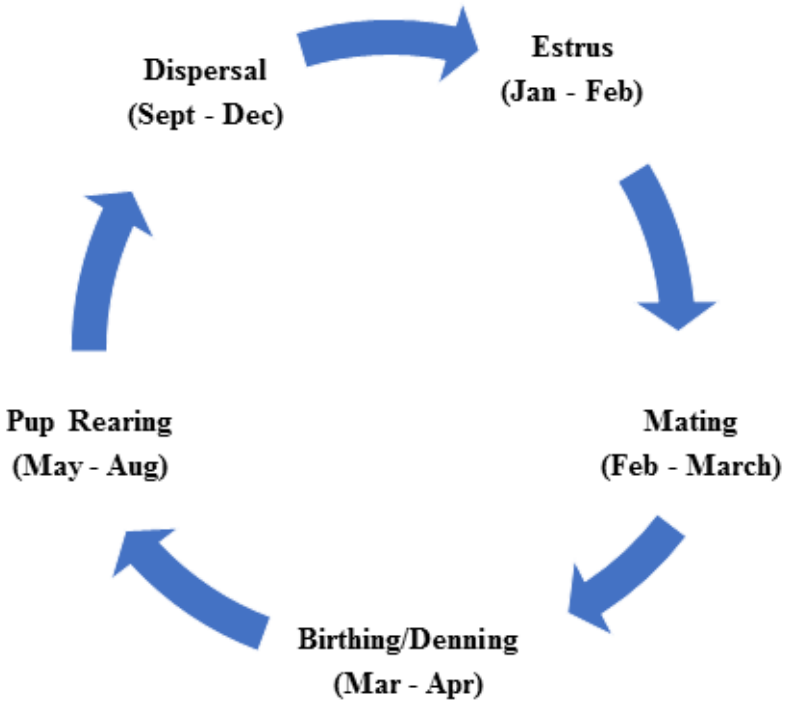
Covering such a vast range is indicative of the adaptability of the modern coyote, as the animal must cope with varying temperatures, terrains, and most importantly, human contact. Over the millennia, coyotes have become accustomed to existence in harsh desert conditions to dense forest landscapes in the northeast. Southern California, prior to the 20th century, was mostly sagebrush and grassland. More recently in their evolution however, coyotes have learned to adapt to life in the urban matrix, as civilization continues to encroach on their natural habitats that remain.

Mating Habits

Coyotes' mating habits follow a particularly consistent pattern. Females of the species enter into estrus in January and February to attract male coyotes. Once a suitable mate is found, there is little to no opposition from rivals and the pair proceeds with breeding. During this time, the pair must also establish a suitable den location where pups will be reared (Way, Auger, Ortega, & Strauss, 2001). Studies tracking mating habits of coyotes have provided qualitative observations that are common to most dens. These include sites dug into the ground beneath an established root system [i.e., locations with strong drainage that are usually slightly elevated, locations within one-half mile of a water source, and locations with some degree of ground cover for coyote protection and escape (Way et al., 2001)]. Contrary to popular belief, coyotes do not reside year-round in dens. Rather, they only use dens for raising pups. In addition, coyotes typically select a different den every year, though they have been known to use the same den in consecutive years (J. Brown & S. Riley, telephone interview, April 6, 2017).

Following a 60-63 day gestation period, female coyotes give birth to a litter of pups from mid-March to mid-April. The pup-rearing period continues from May to August, during which time food demands for females increase. Unlike many large carnivore species, once paired, coyotes remain monogamous for the remainder of their breeding years. Additionally, they also raise pups together, with the male collecting prey for the female for a portion of the pup-rearing phase. Due to the vulnerability of the pups during this period, coyotes may become more aggressive towards perceived threats that encroach near their den sites. In contrast, it has been observed that if contact with a human is made near a den site, coyote pups are subsequently moved. This suggests that coyotes may have alternate den sites available or utilize den sites from previous years (Way et al., 2001). As pups continue to grow, they also begin venturing out farther within their parents' home range, eventually accompanying their parents to learn how to forage. As the pups become more independent during this time—also known as the dispersal period (September through December)—they can remain with their family groups, or sometimes separate and head out on their own (Way et al., 2001).

Figure 1
Coyote Life Cycle



Diet

Though coyotes are mostly carnivorous, the breadth of their diet is much more expansive than their relatives, such as the gray wolf. Subsisting primarily on small mammals such as rodents and rabbits, coyotes are known to consume invertebrates, insects, and vegetation as well. Although coyotes typically prefer fresh meat, they will scavenge for animal carcasses if the opportunity presents itself. An adult coyote requires approximately 1 – 1.5 lbs. of food per day in order to sustain itself (Gehrt, 2007).

Home Range

Variations in coyote home ranges and territories depend primarily on two distinct parameters: 1) availability of resources (food and water), and 2) whether a coyote is paired with a mate (resident) or is transient (no paired mate). In more natural, less developed habitats, coyotes typically have home ranges of approximately 10 km^2 for resident coyotes and approximately 84 km^2 for transient coyotes (Kamler, Ballard, Lemons, Gilliland, & Mote, 2005). When compared to coyotes living in more urban environments, these home ranges and territories shrink considerably. In one study, home ranges of resident urban coyotes varied between 2.27 km^2 to 6.04 km^2, while transient urban coyotes averaged 26.8 km^2 (Gehrt, Anchor, & White, 2009) This is consistent with the resource availability that would be present in an anthropogenic environment.

Resident coyotes exhibit territoriality and defend their home ranges, particularly during

pup-rearing season. This is also dependent on how much their den sites are infringed upon by intruders. Transient coyotes, on the other hand, do not share this penchant for defending a specific area of their home ranges. They oftentimes overlap with other transient coyotes or contain resident coyote home ranges within their own (Gehrt, 2007).

Coyotes in Torrance and Urban Environments

As it pertains to the apparent increase in both sightings and pet takes involving coyotes in the city of Torrance, it is important to understand that these animals have existed within the urban matrix since the area first developed. In fact, much of the Los Angeles metropolitan area has been fully developed for several decades. Therefore the wildlife that remains in the area was not displaced in a traditional sense, further into the urban environment, as that which occurs at the edges of the developed landscape. Due to their high level of adaptability, coyotes appear to not only survive in urban environments, but also know how to thrive within them.

A consistent trend over the years has been the migration of people moving from rural regions into urban centers. The edges of natural habitats and larger cities, particularly in the United States, have remained fairly stable over time. As human populations continue to grow, so too it seems, does the number of human-wildlife interactions both near areas of residence and recreation. Despite the increasing frequency of human-wildlife contacts, it is rare for a coyote to intentionally attack or bite a human. However, when human bites do occur, a recent study found that coyotes are typically interested in the individual as a potential food source (Gehrt & White, 2009). Of particular interest to the City of Torrance regarding human bites, another study documented that nearly half of bites occurred in California (Gehrt & White, 2009). An additional study found that 75 documented human bite incidents in the U.S. occurred between 1978-2003, with the majority occurring from 1995 onward (Timm, Baker, Bennett, & Coolahan, 2004).

As rare as coyote attacks on humans are, fatal attacks are even less likely, with only two fatal attacks documented in North America: 1) Kelly Keen, Glendale, CA, 1981 and 2) Taylor Mitchell, Nova Scotia, BC, 2009. When a coyote bit a human as a predatory response, oftentimes the attack involved a small child, usually under the age of 10. In the instances where a human was bitten, it is important to understand the activity of the individual prior and during the incident. Most adult attacks occurred during some type of recreational activity (47%), and child victims were predominantly outside playing near their residences prior to attacks (75%) (Gehrt & White, 2009). More predatory attacks involved small children possibly due to coyotes viewing them as a prey source, as well as coyotes being stimulated by their actions during play such as running or other high-spirited behavior. Frequency of attacks was highest during the pup-rearing season, which could have been related to aggression in protection of den sites. However, authors of the study (Timm et al., 2004) acknowledged this could have been due in part to the pup-rearing period coinciding with the summer months, during which school age children are typically on break.

Recent Studies

Urban coyotes, as a research topic, is still a relatively new specialization within wildlife research. Much of the current literature lends itself to pose more questions than answers. A

potential drawback to much of the research to date is the definition of what constitutes an urban coyote. This might differ between researchers, as well as the general public. For purposes of academic studies, "urban" appears to include what many individuals would consider "suburban," characterized by large swaths of residential tract homes that perhaps encroach on remaining parcels of natural habitat. That is not to say certain trends cannot be extracted from the studies done or are currently in progress.

For example, Dr. Stanley Gehrt, the principal investigator of the Cook County Coyote Project, has conducted comprehensive research on urban coyotes, both in volume and breadth of topics. However, it is still important to note that many of the Global Positioning System (GPS) collar tracking studies conducted have been confined to a portion of suburban Chicago that included O'Hare International Airport, but not much of the denser core of the city proper. A very recent and spatially relevant GPS tracking study examined the movement patterns of coyotes that were collared in Los Angeles. Justin Brown of the United States National Park Service (NPS), conducted a radio collar study of urban coyotes, believing that individual coyotes would gravitate towards large open spaces (Brown, 2016). However, he observed that one coyote (C-144) resided in the densely populated Westlake district, just west of Downtown Los Angeles. Another coyote (C-145) spent all of his time in a small pocket of the Silverlake neighborhood, north of the reservoir (Brown, 2016). This is the only research encountered in this study that attempted to document the behavior of coyotes where human development had reached such an advanced stage.

Changes in Behavior of Urban Coyotes

Although the NPS collar study occurred within a highly developed area like Los Angeles, there are several key facts about the natural behavior of urban coyotes that have potentially helped coyotes adapt to life in urban environments. In fact, based on the Project Team's findings that will be outlined later in this report, an argument can be made that coyotes are no longer adapting to the urban environment, but rather, are now fully integrated into it. Some of these changes in activity and behavior have been observed and documented in studies such as the NPS study in Los Angeles where there is little to no natural habitat remaining. For example, during a tracking session of a collared coyote in Los Angeles, Brown observed coyotes adeptly utilizing streets in much the same way as a human pedestrian would. In the early morning hours, Brown observed a coyote approach an intersection, but stop a short distance away. After checking for vehicular traffic on the roadway, the coyote proceeded to cross the street safely to carry on its way (Brown, 2016). This type of behavior for urban coyotes has been documented in other radio collar studies as well. Another study found that coyotes in urban environments used city streets and corridors approximately 60% of the time (Tigas, Van Vuren, & Sauvajot, 2002). In contrast, coyotes only travelled on open pathways such as culverts and washes during times of high traffic, which the authors hypothesized could be due to the availability of cover to mask their movements.

Another change in behavior observed in a study conducted by Seth Riley, also of the U.S. NPS, found coyotes living in urban environments tended to shift the majority of their activities to nighttime hours (i.e., after 5:00 PM). It is during these hours that coyotes were tracked moving through fully developed commercial and residential areas, as well as "altered open" areas, which

included municipal parks, landfills, and golf courses. This would seem to indicate that although coyotes seem fully adapted to life in urban environments, they seem to proactively avoid human contact. In addition to travel patterns, both resident and transient urban coyotes have much smaller home ranges than their rural counterparts, with resident coyote home ranges being even smaller than transient coyote home ranges. This is to be expected as wildlife home ranges are typically dictated by the amount of resources available within a specific area (Gehrt, 2007).

Dietary habits of urban coyotes are of particular concern to residents as the presence of domestic cats found in urban coyotes' scats demonstrates a slight shift in food preference. Even with evidence of domestic cats (up to 16% in one study), a significant portion of the urban coyote's diet still relies heavily on its natural prey, such as rodents and rabbits (Larson, Morin, Wierzbowska, & Crooks, 2015). In urban areas where the availability of cats is abundant, it appears coyotes still prefer their natural food sources (Fedriani, Fuller, & Sauvajot, 2001). In some cases, coyotes may kill domestic cats without consuming them, because they are perceived as direct competitors for coyote prey sources (Gehrt, 2007). Also, researchers advised that simply because domestic cats are found in coyote scats, this does not necessarily mean these cats were killed by the same coyote. Coyotes are opportunistic predators by nature, and they will take advantage in the presence of an already deceased cat (J. Brown & S. Riley, telephone interview, April 6, 2017).

Another misconception is that coyotes will opt to rifle through unattended, unsecured garbage receptacles. However, behavior of coyotes observed in a municipal park where such trash receptacles were present seemed to counter this notion, because the coyotes ignored the trash cans and focused on small rodents that were near the trash cans (Brown, 2016). This would lead one to believe feeding smaller prey animals, whether intentionally or unintentionally, influences the presence of coyotes.

6. Stakeholder Interest

The Project Team identified the following stakeholders as parties interested and affected by coyote activity in Torrance, CA:

Torrance Residents & Neighborhood Association Groups

The residents of Torrance are significantly impacted by coyote activity as they themselves, their families, and their pets are susceptible to interactions with coyotes. These interactions can be manifested through observations of coyotes in urban and suburban neighborhoods via coyote sightings in backyards, parks, or green spaces. Interactions may even entail coyotes biting or killing pets. Instances of coyotes stalking small pets, and even those on leashes, have been reported as well.

The State of California

The State of California is also a stakeholder as state laws, rules, and regulations govern how coyotes can be transported, targeted, and even killed in California. State laws prohibit the trapping, removal, and relocation of wild animals unless an individual conducts euthanasia of the

animal. State law also prohibits the feeding of wild animals (Los Angeles Board of Supervisors Executive Office, 2016). The State of California, Department of Fish and Wildlife is tasked with regulating these laws, including ticketing and fining individuals who commit illegal trapping, removal, or relocation acts. The CA Department of Fish and Wildlife is also liable for ticketing individuals who feed wild animals.

City of Torrance: Mayor & City Council

The City of Torrance Mayor and City Council are also stakeholders as the City and its elected representatives are responsible for implementing policies and listening to citizens' concerns regarding coyote activity. City Council meetings are an avenue where Torrance residents may inform City leaders of how the coyote issue has affected their lives. In the Project Team's observations, citizens utilized City Council meetings to voice their concerns to the Mayor and City Council and to demand that comprehensive plans and policies be established to address the growing coyote problem within the community.

Torrance PD

Torrance PD is also a stakeholder as the department is the City entity tasked with managing and responding to coyote incidents within the city's boundaries. Torrance PD has established a comprehensive coyote management plan, and it utilizes this plan to educate, investigate, and ensure public safety in Torrance. As previously detailed, Torrance PD tracks data regarding coyote activity, and it is the responding unit that arrives on the scene when threatening coyotes are reported in the city. The Coyote Management Team provides the Torrance Mayor and City Council with updates regarding Torrance PD's efforts to mitigate human-coyote interactions.

Animal Rights Groups & Environmental Organizations

Animal rights groups and environmental organizations are additional stakeholders that are interested in coyote activity across Torrance. These groups tend to approach the issue from a protection and advocacy lens. Organizations, such as Friends of Madrona Marsh located in Torrance, seek to protect and preserve native species, including coyotes. These organizations review and analyze coyote management plans to ensure that they remain ethical and legal.

Veterinarians & Trappers

Additionally, veterinarians and trappers are industry experts that can trap or treat coyotes when requested. These professionals offer their services and intervene when coyotes are injured or when the removal of coyotes and subsequent euthanasia are needed. In some communities, trappers are independently hired by homeowner associations in an attempt to remove certain coyotes that present a clear and immediate danger to the public.

7. Legal/Policy Issues

The California Department of Fish and Wildlife regulates the trapping and capture of wild animals and, as previously stated, prohibits the removal or relocation of these animals unless euthanasia is conducted. These laws very clearly pertain to coyote populations and as stated by the California Department of Fish and Wildlife, "...nongame birds and mammals may not be taken" (California Department of Fish and Wildlife, 2015, p. 10). Federal, State, County, and City legislation all prevent the trapping and removal of wildlife from their natural habitats. However, despite these laws, proponents of trapping and removal still exist. They suggest that targeted or random trapping of coyotes can be effective methods for reducing coyote populations.

While regulations dictate that trapped coyotes must be euthanized, the Project Team found that certain industry experts believe that the random removal of coyotes from their habitats is not an effective method for coyote reduction. Researchers from the University of Nebraska, Lincoln conducted computer simulations that factored in coyote behavior and demographics (i.e., sex, age, status, pack membership, etc.) and found coyote populations recovered within one year when randomly removing 60% of coyotes from the population (Pitt, Knowlton, & Box, 2001, p. 104). Coyote populations recovered within 5 years when randomly removing 90% of coyotes from the population (Pitt et al., 2001, p. 104). Such research has been acknowledged by municipalities in Southern California, and many cities and counties have decided to interpret these findings as causes for non-pursuit of random removal tactics. However, a select few cities have chosen to utilize legal targeted removal tactics, despite the requirement of euthanasia, which will be described in further detail below.

8. Ethical Considerations

Coyotes are found in urban areas, despite heightened exposure to humans and subsequent human-coyote interactions that may follow. While coyotes are wild animals, humans have commented on coyote conditions and coyote treatment. Animal welfare groups and their supporters have become intertwined in the urban coyote discussion due to their interests in the preservation, health, and wellness of urban coyotes. Most advocacy groups vehemently oppose trapping and removal techniques that result in euthanasia. Some groups have even supported the feeding of urban coyotes. A recent incident in Alhambra, CA further solidified the notion that advocacy groups and city residents—in some cases—may feed and nurture coyotes. In March 2017, Alhambra residents admitted to feeding and nurturing a wild coyote they encountered in their neighborhood (Yee, 2017, p. 1). City and state officials suggested their actions were in violation of feeding laws, and they may have caused the coyote to become habituated to humans and the food sources humans provide.

Additionally, animal rights advocates have observed the differing policies and positions that cities in Southern California may take as they adopt municipal urban coyote management plans. These groups have denounced and taken legal action against cities they believe have enacted cruel policies. In Arcadia, CA, People for the Ethical Treatment of Animals (PETA) recently sued the City of Arcadia for its adoption of a trapping policy that permitted the City to establish a contract with a trapper to catch and subsequently euthanize coyotes in the area. In March 2017, an Arcadia resident and PETA filed a joint lawsuit against the City due to its adoption of the trapping policy. The plaintiff stated that "killing them is not a justified action"

(Yee, 2017, p.2). Animal welfare organizations and certain residents will always be concerned about the conditions of coyotes in their localities. However, by working together with municipal leaders, these groups can help address urban coyote issues both in a considerate and comprehensive manner.

9. Research Methodology & Data Collection

Qualitative Methods

The Project Team conducted an extensive literature review to examine the behaviors of coyotes, including how they have adapted to life in urban environments. An online search via the University of Southern California's Libraries tool was conducted to locate research studies and articles from peer-reviewed, academic journals. Information obtained from these sources was used to assess both coyote behavior and any methods utilized to manage coyote interactions with humans. In addition to academic journals, the literature review included print journalism and media accounts of recent coyote-human bites in the Southern California region, which was used as a reference guide for subsequent information collection methods.

Interviews were conducted with individuals that were directly involved with the crafting and implementation of Torrance PD's Coyote Management Plan in order to establish a baseline for the Project Team's research. At the Project Team's initial meeting with Captain Martin Vukotic, Commanding Officer of Torrance PD's Special Operations Bureau, the Project Team was provided with the contact information of wildlife experts with detailed knowledge of coyote behavior and techniques used to mitigate coyote-human interactions. Interviews with Lieutenant Kent Smirl and Dave Dodge, who both work with the California Department of Fish and Wildlife, were conducted to explore possible explanations for the apparent increase in observed coyote activity in Torrance and the role of the California Department of Fish & Wildlife regarding urban coyote management within the state. Additional interviews were conducted for wildlife expertise with Dr. Niamh Quinn, Human-Wildlife Interactions Advisor for the University of California Cooperative Extension, as well as Tracy Drake, Manager/Naturalist at the City of Torrance Madrona Marsh. For specific information regarding coyote data (i.e., sightings and pet attacks) collected within the city, the Project Team was referred to Lieutenant Jennifer Uyeda and Sergeant David Koenig in Torrance PD's Traffic Division. In addition to providing the Project Team with coyote data, Lt. Uyeda and Sgt. Koenig further described the specifics of Torrance PD's Coyote Management Plan and how it was implemented.

For purposes of independent analysis, academic experts were contacted to confirm, refute, or expand upon preliminary conclusions obtained in the Project Team's initial expert interviews and literature review, with questions used during previous interviews as a template—depending on the expert's field of research or study. Included in these interviews were Justin Brown, of the United States National Park Service, who conducted a GPS collar tracking study of coyotes in the urbanized core of Los Angeles, CA, as well as Dr. Seth Riley, also of the United States National Park Service, who has published articles of his own research on urban coyotes in the western edge of Los Angeles County. Further insight into coyote behavior and interactions with humans was obtained through interviews with: 1) Dr. Robert Timm, Extension Wildlife Specialist for the University of California Hopland Research and Extension Center, 2)

Dr. Winston Vickers, Associate Veterinarian for the University of California Davis Wildlife Center, and 3) Dr. Travis Longcore, Assistant Professor of Architecture, Spatial Sciences, and Biological Sciences at the University of Southern California. To ensure a comprehensive review occurred, factors such as the effects of California's recent drought, were explored. Dr. Kevin Anchukaitis, of the Woods Hole Oceanographic Institution, and Dr. Dan Griffin, of the Department of Geography, Environment, and Society at the University of Minnesota, were interviewed to learn if there may be a scientific link between the environment and wildlife behavior.

Evaluation of the coyote management program Torrance PD has implemented required an examination of policies, procedures, and philosophies regarding urban coyotes employed by other jurisdictions in the region. Municipalities contacted for this purpose were selected primarily based on published human bite incidents, with the rationale that avoidance of a human bite is the paramount objective of a coyote management program. Some jurisdictions, such as Newport Beach (Officer Castro, Newport Beach Police Department) and Culver City (Officer Corolla Fleeger, Animal Services Officer, Culver City Police Department), maintain animal control services as a subsidiary of the police department. In contrast, Los Angeles (Officer Hoang Dinh, Animal Services Officer, LA Department of Animal Services – Wildlife Division) and Long Beach (Ted Stevens, Manager, Animal Care Services Bureau, City of Long Beach) maintain a separate department to handle residents' animal control requests. Other cities contacted, such as Anaheim (Sarah Nawaz, Orange County Animal Care) and the La Canada-Flintridge neighborhood (Peter Castro), maintain contracts with non-governmental agencies who advise individuals on where to find further information.

Several cities the Project Team contacted stated that they do not have a formal coyote management plan in place, or they adopted a plan similar to the one provided by the California Department of Fish and Wildlife. The communities of Altadena and Valencia, both which contract with the Los Angeles County Sheriff's Department for law enforcement services, advised they only respond to reports of coyotes that are aggressive towards humans. Furthermore, the case studies conducted of neighboring cities in the region also served to assess whether any tactics employed could prove useful.

Quantitative Data & Analysis

Torrance PD began to officially document sightings of coyotes and pet attacks ("takes") in June 2016. These sightings and attacks were represented visually on a map of the city. Sgt. Koenig provided this raw data to the Project Team for the period of June 2016 through December 2016 in the form of an Excel spreadsheet. The spreadsheet itself was subdivided into the following categories: Sightings, Dog – Non Fatal, Dog – Fatal, Cat – Non Fatal, Cat – Fatal, Fox – Fatal. Officials did advise upon supplying this information to the Project Team that during the early stages of data collection, only the locations and the times of reports were logged for the 2016 data set.

A later iteration of the data included time of day for sightings and attacks, as well as circumstances surrounding coyote encounters. This updated form of data is currently in use by Torrance PD via a GIS mapping program (ArcGIS Online) which projects sightings and the

various categories of pet attacks on a satellite basemap of the city. Coyote activity data for the period of January 2016 through March 2017 was obtained from this online map by filtering activity in the date range field, then displaying the attributed data for the layer of data projected on the map. This data was then downloaded in comma-delimited (CSV) format which is compatible with the Microsoft Excel program. In addition, the Project Team and other City officials were provided with weekly updates on coyote activity in Torrance. These reports detailed sightings, cat and dog attacks, descriptions of any human encounters, and notes as to whether or not any hazing techniques were used.

Data collected was inputted by the Project Team into a GIS platform (ArcGIS 10.4) to generate a spatial representation of all reported coyote activity, separated into sightings and attacks. The Project Team was advised by Sgt. Koenig that all dogs included in the data set thus far have been small breeds. Mapping attacks together was for the purpose of establishing possible coyote hotspots and trends in migration throughout the city. It is understood that time of day and nature of an encounter (i.e., presence of human) can play a significant role in determining whether contact should be considered aggressive.

Data points were plotted using "X Y" coordinates (latitude, longitude) onto a shapefile map (U.S. Census Bureau, TIGER) of Torrance, which was then layered with Census block group level delineations. Once projected onto the shapefile map, both sightings and pet attacks were assigned a number (1 - June 2016 to 10 - March 2017) to establish magnitude from oldest to most recent monthly activity. The data could then be projected using a color ramp with individual points represented by a specific color indicating month of occurrence (lighter = older, darker = most recent). Data points were also compared in relation to "open-altered" areas within the city such as municipal parks and schools (LA County GIS Portal, Landuse shapefile). Next, a buffer zone (0.25 mile) was established around these areas to determine if there was any spatial significance to coyote activity around these locations. Demographic data from the United States Census Bureau (American Community Survey Estimates, 2015) was embedded into the Torrance block group shapefile and projected as a choropleth map. Categories included were median household income, population density, housing unit density, foreign language spoken at home (Asian Pacific Islander languages and Spanish; Figure 2 and Figure 3), and households with at least one person over 65 years of age (to examine possible reporting bias).

Figure 2

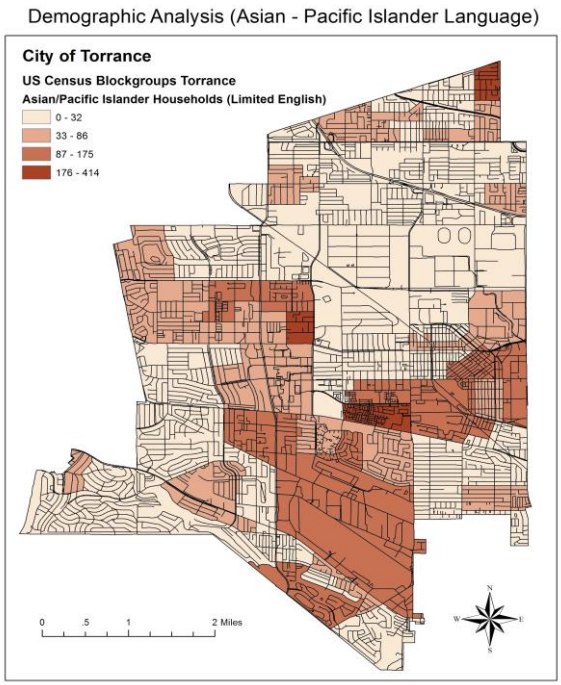
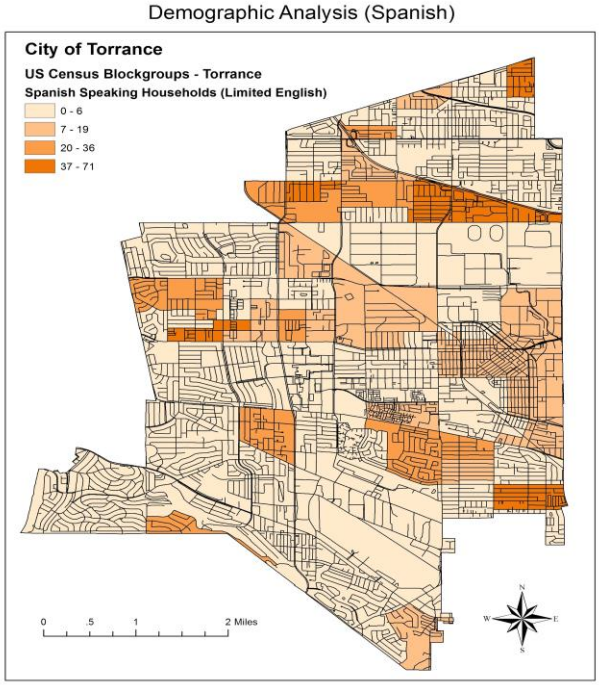


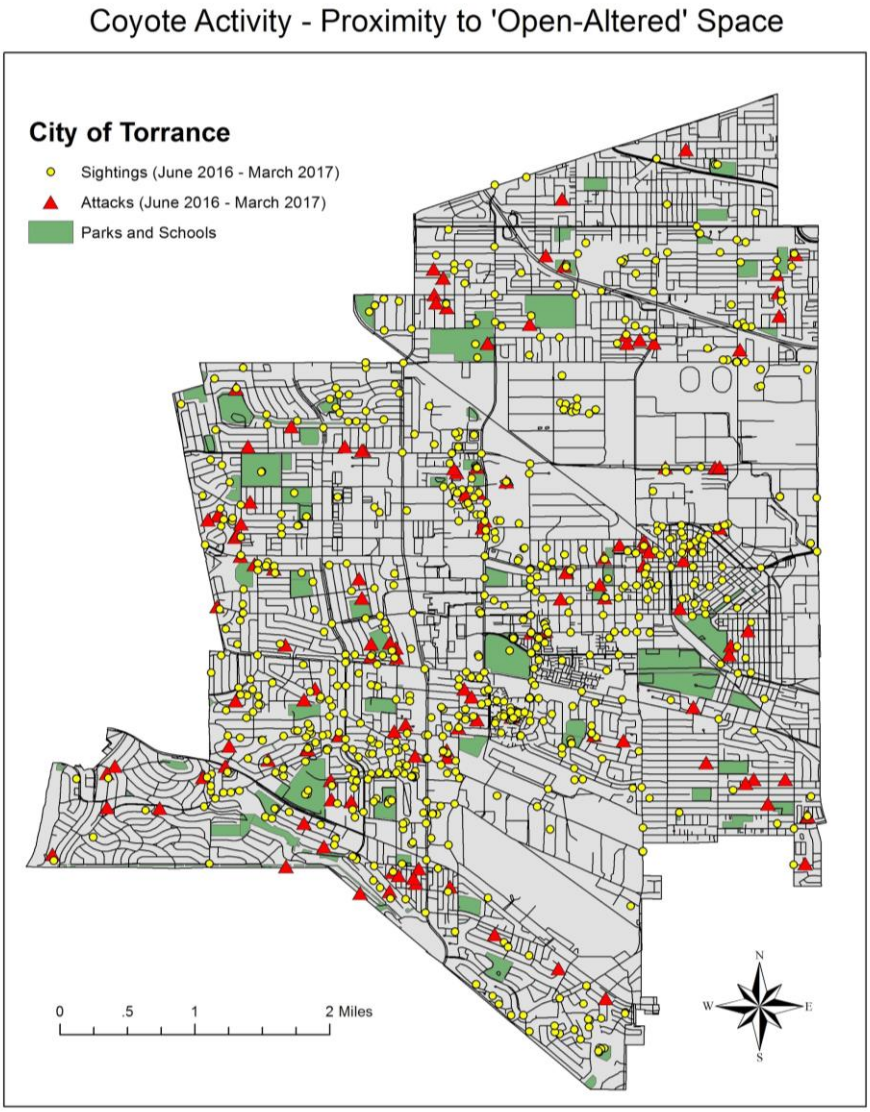
Figure 3



The Project Team's preliminary examination of the spatial mapping of coyote activity appeared to support research findings that coyotes in urban environments tend to gravitate towards locations that closely resemble their natural habitats (Figure 4). Both sightings of coyotes and pet attacks roughly mimicked the layout of these "open-altered" spaces (Appendices C and D, respectively) and generally occurred within a 1000 ft. buffer zone of these spaces, with the exception of a cluster of activity in the eastern edge of the city. This was identified as the southern tip of the Torrance Refinery, which would likely be considered a fully developed locale.

In looking at sightings and attacks in relation to their month of occurrence, an apparent trend over time indicates a shift from the western portion of Torrance to the east and north ends of the city (Appendices A & B). While occasional sightings and pet takes occurred to the west, the Project Team hypothesizes that the absence of a significant amount of recent activity may indicate that measures previously implemented by Torrance PD could have impacted the coyote population, pushing coyotes to areas with more readily available resources and less human interaction. However, it is important to be cautious as this can only be inferred by the Project Team from the data displayed, and more support for this assertion is needed to establish any causal link between location of activity and management strategies.

Figure 4



When compared to demographic data, more recent sightings and pet attacks in the northern end of Torrance occurred in an area with higher Spanish speaking residents who also identify as having limited English speaking skills. Furthermore, when compared to prior sighting data, it appears there is a higher proportion of confirmed pet attacks compared to the number of sightings reported. A possible explanation is that education materials disseminated to residents regarding coyote reporting, hazing, and management may not have been fully understood. To reiterate, this is only an inference made by the Project Team based on the mapping data provided. A direct link to a language barrier requires further investigation that is beyond the scope of this study. However, mapping of activity and any pertinent demographic data provides a useful tool in support of any policy or management strategies that may be implemented.

10. Key Findings

Research Question Observation

Coyote Activity Increase vs. "Perceived" Coyote Activity Increase

In the initial stages of research, the Project Team sought to explore the factors believed to have caused an increase in coyote activity in Torrance, CA. However, after reviewing a wide

variety of academic literature and data sources, as well as speaking with numerous wildlife experts, the Project Team found it to be scientifically inconclusive as to whether or not there has been an increase in coyote activity—or an increase in coyotes numbers—in Torrance, CA. As stated in *The City of Torrance Coyote Management Plan*, accurate coyote tracking data within the city did not occur until 2016, so "it is difficult to exactly know the increase in numbers of coyotes in the area" (Torrance Police Department, n.d., p. 6). Although the number of coyote-related reports (i.e., sightings, pet attacks, deceased pets, etc.) received by Torrance PD were frequent during the summer months of 2016, wildlife experts have suggested that without detailed and extensive tracking of all coyotes and coyote behaviors within the city over an extended period, the assertion that coyote activity has increased in Torrance, CA cannot be scientifically defended. Rather, this "increase" can only be regarded as perceived or speculated by the academic community at the current time.

While various experts support the idea that more data is needed to make the scientific claim that coyote activity has increased in Torrance, CA, this is not to say that the presence of coyotes in the area is not a topic of resident and community concern. After attending a Torrance City Council meeting where coyote issues across the city were discussed, the Project Team was made aware that the perception of increased coyote activity is a reality for Torrance residents. Both the fear and frustration surrounding coyote sightings and coyote attacks, especially those associated with domestic pet takes or domestic pet kills, are evident throughout the community. Academic experts have commented on the presence of public fear, and they have also identified sensationalist news headlines, social media posts, and duplicate sightings and/or attack reports as possible factors that have perpetuated the notion of increased coyote activity in Torrance, CA. All aspects considered, the Project Team decided to modify its research approach in order to explore the factors that have *influenced* coyote activity in Torrance, CA, rather than the factors believed to have *caused an increase* in coyote activity in Torrance, CA.

Human Behavior Factors & Coyote Activity

One of the primary factors the Project Team found to be frequently attributed to urban coyote activity in Southern California is human behavior. As previously described, the Project Team spoke with numerous wildlife experts, including coyote ecologists and biologists, who commented on the ways that human behavior can ultimately influence a coyote's actions. While many human factors were discussed in the interviews conducted and the literature reviewed by the Project Team, the most commonly reported human behaviors were 1) direct feeding of coyotes, 2) indirect feeding of coyotes, and 3) inappropriate hazing. Frequent statements made by experts were that the Southern California coyote issue is "really a people issue" and "human behavior plays a significant role in creating and solving human conflict with wildlife" (Conover as cited in Orthmeyer, Cox, Turman, & Bennett, 2007, p. 346). This section describes this behavior in detail, and it also provides insight on the possible relationship between another aspect of human behavior and urban coyote activity—construction.

<u>Direct Feeding of Coyotes</u>

Over the course of the research study, the Project Team both heard and reviewed many statements regarding the direct feeding of coyotes by humans. From intentionally leaving extra

pet food, water, etc. outside for coyote consumption, to feeding coyotes by hand, there are many forms in which human behavior has directly influenced coyote diets in Southern California. According to multiple urban coyote experts, this type of human behavior has helped coyotes determine that there are frequently available food sources in urban areas and that humans tend to provide favorable and sustainable feeding conditions for coyotes. While the intentional feeding of coyotes and other forms of wildlife is against California state law, "due to varied interpretation and difficulty in proving a violation," this law is "not often enforced" (Orthmeyer et al., 2007, p. 347). It has also been said that coyotes can be attracted to urban and suburban environments "where they can utilize water sources, pet food, household refuse, and even house cats and small dogs as prey" (Timm et al., 2004, p. 47). In addition, there have been research studies conducted on urban coyote diets which have revealed numerous human-based food sources and pet food sources as components of urban coyote diets.

The intentional feeding of coyotes has been deemed by various academic experts as a recipe for disaster, and it has "been linked to many coyote problems, including several human attacks" (Orthmeyer et al., 2007, p. 346). One instance occurred in 1997 when a man attempted to feed a coyote in California and was subsequently attacked and bitten by the coyote (Timm et al., 2004, p. 49). Another instance occurred in 2001 when an 8-year-old girl was attacked by a coyote in San Diego, CA (Timm et al., 2004, p. 49). The girl's family fed the coyote previously at the family's apartment. However, despite efforts to peacefully engage with the coyote, the girl was bitten on the leg by the animal. While these are only two examples, similar attacks have occurred throughout Southern California over the years. These situations have sparked concerns surrounding the feeding of coyotes and the effects this type of human behavior can have, including a continued presence of coyotes in urban areas.

Indirect Feeding of Coyotes

Not only has the intentional feeding of coyotes by humans influenced coyote activity in Southern California's urban areas, but the unintentional feeding of coyotes by humans has also influenced coyote activity in these locations. Some experts have argued that indirectly feeding coyotes can have significant impacts on coyote behavior, particularly when it comes to feeding and sustaining coyote food sources, such as feral cats and other prey. As discussed previously, feral and domestic cats are common components of coyote diets in urban areas. Such interactions have been particularly known to "lead to increased conflicts with humans in urban areas" (Larson et al., 2015, p. 345). In Torrance, CA specifically, there have been 86 reports of deceased cats from coyotes, from June 2016 to the beginning of April 2017 (Torrance Police Department, 2016-2017). It has been said that feral cat feeder activist groups can perpetuate this issue by making deliberate efforts to feed feral cats in Southern California communities, which in turn, can help sustain a food source for coyotes in urban areas.

Indirect feeding of coyotes in urban areas can be present in multiple other forms, such as allowing domestic pets to roam freely without supervision, not picking up fallen fruit in parks and residential yards, leaving household refuse outside and accessible to coyotes, and more. All of these sources have been known to contribute to coyote diets in urban areas. Simply leaving a domestic pet outside without supervision can be a significant attractant to urban coyotes which can automatically place pets in the coyote food chain. Numerous experts have articulated that a

coyote attacking an animal in a person's backyard is not aggressive behavior. Rather, it is "opportunistic predator behavior" (N. Quinn, telephone interview, March 10, 2017) and even more so, normal coyote behavior.

When discussing the indirect element of feeding with additional coyote and wildlife experts, the Project Team frequently heard comments identifying coyotes as opportunists. All it takes is for one person to engage in these behaviors to attract one or more coyotes to an area and potentially cause a domestic pet-coyote encounter or a human-coyote encounter. Further statements were made that deemed indirect human feeding of coyotes as a serious concern in Southern California, because it establishes habituation of animals and decreases coyote fear of urban environments. Thus, when it comes to the perceived heightened presence of coyotes in urban areas—specifically in Torrance, CA—indirect feeding of coyotes by humans is a contributing factor that warrants further attention.

Inappropriate Hazing

Aside from direct and indirect feeding of coyotes by humans, there is another human factor that the Project Team identified that can influence urban coyote activity—hazing. By definition, coyote hazing is "deliberate aversive conditioning that employs immediate use of deterrents or negative stimulus to move an animal out of an area, away from a person, or discourage an undesirable behavior or activity" (Bonnell, 2016). While it is widely debated in the academic community as to the ultimate effectiveness of wildlife hazing practices, several experts have stated that knowing when to haze and when not to haze, as well as appropriate hazing methods, is essential (Bonnell, 2016). Experts suggested that if hazing is not conducted at the proper time and in the correct fashion during a human-coyote interaction, the efficacy of such attempts can be impacted both in the short-term and long-term. In addition, the presence of dogs during hazing attempts can have a "muting effect" on coyote hazing (Bonnell, 2016). "If there is a dog around, coyote[s are] less likely to be frightened away," because they are "interested in the dog" (Bonnell, 2016). The dog is "either perceived as competition or in some cases, possibly food" (Bonnell, 2016). Ultimately, the presence of a dog "can impact the ability to haze a coyote away from [a human] effectively" (Bonnell, 2016).

Additionally, if hazing is neither initiated when necessary nor properly conducted, coyotes can grow accustomed to the practice, lose their natural wariness of humans, and display a greater presence in the public eye. In urban and suburban areas, "coyotes can lose their fear of humans as a result of coming to rely on ample food resources" and "the safe environment provided by a wildlife-loving general public, who rarely display aggression toward coyotes" (Timm et al., 2004, p. 46). Coyotes are "very adaptable animals" (N. Quinn, telephone interview, March 10, 2017) and if humans do not take the initiative to alter concerning behavior with negative reinforcement, some wildlife experts have suggested that coyotes can morph into animals that are relaxed around humans and find comfort in residential neighborhoods to the extent that generations of coyotes have possibly been raised in a similar capacity. When the Project Team asked experts about how these findings apply to Torrance, CA specifically, common responses confirmed the aforementioned findings and that a lack of hazing at appropriate times can influence coyote activity in urban areas, including Torrance, CA.

Construction

Over the course of the research study, the Project Team discovered that there is a possible relationship between another aspect of human behavior and urban coyote activity—construction. While the academic support for this relationship has yet to be developed, there is significant speculation that construction projects have the ability to disturb wildlife—including coyotes—and prompt such wildlife to become more active and disperse to new urban areas. Some experts have stated that construction could specifically disrupt coyote hunting grounds and push coyotes to search for additional food sources. However, multiple experts have cautioned that a very extensive and widespread tracking study would need to be conducted to fully develop this theory and its relationship to urban coyote activity, as there are arguments on both ends of the spectrum. For example, when asked if construction projects have either displaced coyotes in Southern California or if construction projects have attracted coyotes in Southern California by providing them with areas for shelter, a mixed expert response occurred. Some experts argued that regardless of activity, if a construction site was previously a part of a coyote's home range or if the site was a previous denning area, a coyote might remain near the site even after the site becomes less suitable for shelter and denning needs. Additionally, other experts stated that construction sites have the potential to attract coyotes, because they have powerful foundations and food can sometimes be left behind for wildlife consumption by individuals working on construction projects. Some Southern California city representatives have even expressed that several coyotes have been found in areas of new home construction, including in Newport Beach, CA (J. Castro, telephone interview, March 17, 2017). Nevertheless, while there is a potential relationship between construction and urban coyote activity, the Project Team's findings in this area are inconclusive for Torrance, CA.

Natural Coyote Behavior Factors & Coyote Activity

Not only have human factors been frequently attributed to urban coyote activity in Southern California, but it has also been argued that natural coyote behavior has played its own role. Multiple experts referenced natural coyote behavior during the course of the Project Team's research, particularly as it relates to coyote reproduction and food source protection. In general, the Project Team found that heightened coyote activity and aggressive actions can be "related to behaviors associated with territoriality, reproduction, and defense of den sites and/or pups" (Timm et al., 2004, p. 53). A specific example occurred in 2003 in Lake View Terrace. A jogger was bitten on the ankle by a coyote after the jogger ran by the neighborhood coyote feeding station (Timm et al., 2004, p. 50). More recently, during the Los Angeles Urban Coyote Project, the mate of one of the coyote's being tracked (C-145) chased after people walking their dogs in an area near the coyotes' den sight (i.e., within a one-block radius; J. Brown & S. Riley, telephone interview, April 6, 2017). The time of day of these instances is significant, but it has been expressed that this type of behavior is simply an innate, defensive quality found in coyotes.

Coyote activity and coyote aggressiveness can also be evident when food sources are at stake. Urban coyotes can become more territorial when they are trying to provide food for their pups or attempting to sustain their own well-being. Coyotes have been found to kill other forms of wildlife—cats in particular—not only as a food source, but also for the purpose of removing rival competitors for food sources (Gehrt, 2007, p. 22). However, motives for heightened coyote

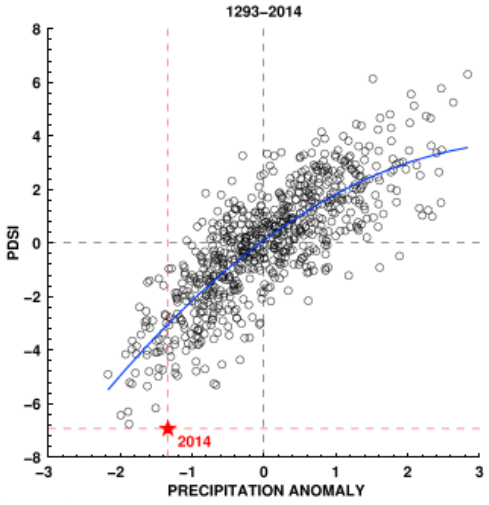
activity or coyote initiated attacks are not always food-related, den-related, or protective in nature (Connolly as cited in Timm et al., 2004, p. 52). “Movement, particularly escape behavior, is a key stimulus for eliciting orientation and attack; children’s play and running behavior, particularly when running away from a coyote, may provide a strong stimulus for attack” (Lehner as cited in Timm et al., 2004, p. 52). Thus, when it comes to the perceived increase of coyote activity in Torrance, CA, all of the aforementioned natural coyote behaviors may contribute to the issue.

Environmental Factors & Coyote Activity

The Project Team received mixed expert responses regarding the effects of the recent drought in Southern California. While scientific evidence exists supporting the severity of the drought, there has yet to be any scientific evidence connecting it directly or indirectly to coyote behavior.

While some experts believe that the drought affected urban coyote behavior, scientific data has not been established that connects climate to the perceived increase in urban coyote activity in Torrance, CA. Climate experts could only attest to the severity of the drought in comparison to previous years. Dr. Daniel Griffin and Dr. Kevin Anchukaitis previously conducted research on the effects of the drought in Southern California. They determined Palmer Drought Severity Index (PDSI) levels through analyzing tree rings and their thinness or thickness, as well as through soil moisture and precipitation. The team determined that “the 2012-2014 drought is the worst in [its] combined NOAA-NADA [National Oceanic and Atmospheric Administration - North American Drought Atlas] estimate and 2014 is the single most arid case in at least the last 1,200 years” (Griffin & Anchukaitis, 2014, p. 9021). Precipitation levels in 2014 were truly an anomaly, as depicted by the figure below (Griffin & Anchukaitis, 2014, p. 9021).

Figure 5



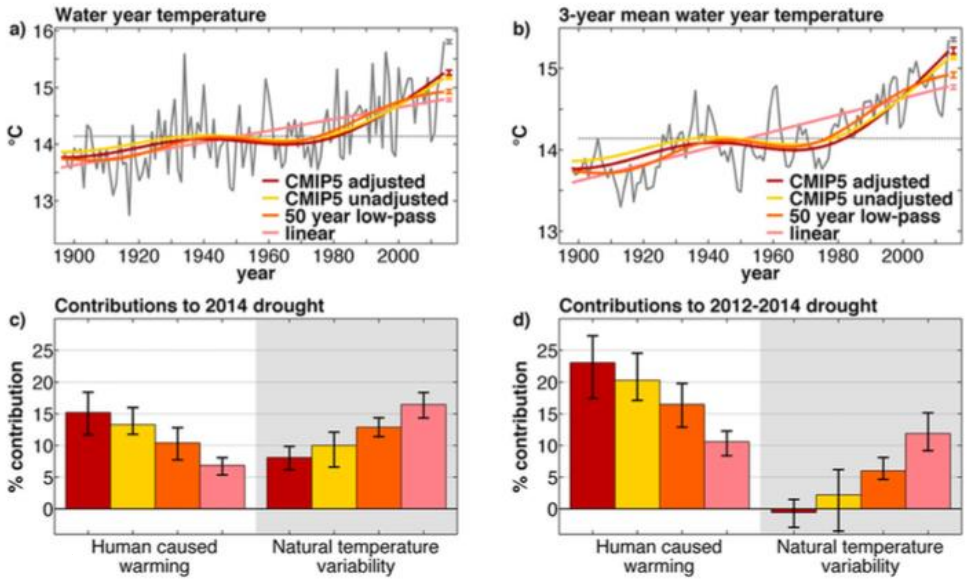
Bivariate distribution of the composite JJA NADA-NOAA PDSI and October–June reconstructed normalized mean precipitation anomalies. The 2014 value is indicated by the red star and dashed red lines and is labeled. The blue curve shows the least squares second-order polynomial fit to the data. Dashed black lines show the zero values for each distribution.

Precipitation levels were extremely low compared to previous years, and they did not follow a similar pattern. The team recognized that external factors beyond the drought may have impacted 2014 levels and caused it to be an anomaly. Furthermore, the drought occurred over consecutive years, which was unique to the region (K. Anchukaitis, telephone interview, March 31, 2017). This limited the time for the environment to quickly rehabilitate itself. Due to historical data and patterns, the team determined that "future severe droughts are expected to be in part driven by anthropogenic influences and temperatures outside the range of the last millennium" (Griffin & Anchukaitis, 2014, p. 9022). In reviewing the team's work, as well as conversing with the team in an interview, the Project Team observed that the drought has been extreme in comparison to historical data. Experts suggested that part of this was due to decreased rainfall. However, Dr. Griffin and Dr. Anchukaitis noticed that temperature had a significant impact. Higher levels of heat and increased production of greenhouse gases are believed to have led to increased negative drought effects.

In order to address this concern, Dr. Griffin and Dr. Anchukaitis directed the Project Team to analyze a more recent study conducted by Dr. Park Williams (D. Griffin, telephone interview, April 3, 2017). His research utilized Potential Evapotranspiration (PET), a method that accounts for temperature levels, as well as potential human impact. He also accounted for anthropogenic warming which is heat produced by factors outside of natural temperatures (Williams et al., 2015). After conducting his research, Dr. Williams determined that the drought was not necessarily as severe throughout the entire Southern California region as previously established by Dr. Anchukaitis and Dr. Griffin, but rather most severe in areas such as the Central Valley. This may have been due to the impact of irrigation levels in areas with farming. Dr. Williams did affirm that anthropogenic warming was a unique factor, and it increased the

intensity of the drought. The following images, from his study, depict the various factors that affected the drought and how human-influenced warming was a main factor (Williams et al., 2015, p. 6825).

Figure 6



Contributions of anthropogenic warming and natural temperature variability to recent temperature and drought. (a) Annual and (b) 3 year running water year temperature records with four alternate scenarios of anthropogenic warming. Contributions of anthropogenic warming versus natural temperature variability to (c) 2014 and (d) 2012–2014 JJA $PDSI_{sc}$ anomalies, where bar colors correspond to the colors of the four anthropogenic warming trends in Figures 4a and 4b. For each of the anthropogenic warming scenarios, natural temperature variability is calculated as the observed temperature minus the warming trend. All time series and bars represent mean conditions across all combinations of climate products. Whiskers bound all values for all combinations of data products.

Dr. Williams utilized both PET and PDSI levels to account for both anthropogenic warming, as well as natural factors. The combination of the two depicts how severe and unique the most recent drought was. While he may not agree with the severity established by Dr. Anchukaitis and Dr. Griffin, Dr. Williams does believe the drought was severe and worsened due to human activity. While not scientifically supported in his study, his conclusion alluded towards the potential negative impacts of human consumption of resources.

In analyzing both studies, the Project Team considered the potential impact the drought may have had on coyote behavior. Wildlife already competes for limited water sources, so it can be speculated that humans add to the demand. While this may not directly affect coyotes, vegetation and wildlife can be depleted due to decreased water sources. This means that the food sources for coyotes may either begin to diminish or head to new territories for food and water. Cascading effects on food and water sources, as well as impacts on coyote habitats, may have led coyotes to become more visible in urban areas in search of these resources. However, some wildlife experts claimed that the drought had little or nothing to do with urban coyote activity in Southern California. They stated that coyotes can obtain most of their water sources from the foods they consume (if necessary). Furthermore, some experts expressed that coyotes are highly adaptable creatures that can live in arid habitats, and they do not require verdant surroundings or

ample water sources to survive. Finally, while scientific evidence exists supporting the severity of the drought, there has yet to be any scientific evidence connecting it directly to coyote behavior. As such, it can be concluded that the perceived coyote activity increase could simply be a correlating factor, not one of causation.

Common Practices Used to Address Coyote Activity

The Project Team conducted over a dozen expert and city case study interviews in order to identify common practices used to address urban coyote activity. It is important to consider that expert and city case study interviews were strictly anecdotal and were based on interviewees' experiences in the field. These experiences were quantified and enumerated below as the most common practices identified.

Education/Outreach

The most common practice found to address urban coyote activity was comprehensive public education programs that inform residents of coyote behavior, food sources, and tactics to prevent human-coyote interactions. City leaders in Southern California suggested that the public should have the opportunity to learn about appropriate hazing techniques, how to protect their pets, and how to reduce human-generated coyote attractants (i.e., reducing accessibility of pet food and water left outside the home). The Project Team found that a majority of the cities in Southern California utilize intensive coyote education programs in an attempt to inform and prepare citizens. These trainings are commonly known as Wildlife Watch programs. In Newport Beach, it was found that the City's Wildlife Watch program has been brought to affected communities that have observed coyote sightings and suffered pet bites or takes. Officer Castro of the Newport Beach Police Department suggested that bringing these programs to coyote-affected communities seemed to increase the program's effectiveness and be positively impactful for citizens (J. Castro, telephone interview, March 22, 2017). Castro asserted that affected communities particularly benefit from these educational programs, as he has found that coyotes tend to return to past attack sites. Similarly, researchers suggested that hyper-emotional information sharing can yield greater understanding of the risks that humans present to coyotes. The Project Team was informed that when community members learn that urban coyotes may reach their demise if they interact with humans, this warning is influential enough to change human behavior and aid in the reduction of human-coyote interactions (R. Timm, telephone interview, April 10, 2017).

Multiple cities in Southern California suggested that educating citizens about hazing techniques is a critical component of their outreach programs. Even as pending studies suggest that hazing may only be an effective short-term scare tactic for coyotes, many cities have incorporated hazing training into their education and outreach programs. Additional components of educational programs the Project Team observed were localized public recommendations made by municipal officials. In Wildlife Watch and other education programs, city leaders suggested that providing localized recommendations to citizens is critical for the public to improve situations or prevent predation from taking place. Recommendations dependent upon locality were provided to the public and shared with the Project Team, including: 1) exclude ease of coyote access to one's yard or property, 2) protect livestock via penning or fencing, 3) confine

or house animals and other resources, etc. Specialized and localized recommendations provided in educational programs were essential for cities to convey unique information and instructions to residents.

The Project Team's case study research revealed that certain communities, such as the Canyon communities, have a keen understanding of the dangers of human-coyote interactions. Residents in these communities are aware that they should not leave their pets or food outside or leave their pets unattended in yards. This level of awareness and preparedness arguably helps reduce human-generated attractants and limits coyote access to food. This level of understanding and awareness is also argued to be the product of comprehensive coyote education and outreach programs. As indicated by multiple experts, when urban coyote issues are directly managed and citizens are educated, citizens are able to understand the nature of the circumstance and modify their behaviors.

Hazing

Hazing was the second most commonly reported tactic among the Project Team's case study interviews. Beyond implementing hazing techniques into education programs, certain cities rely on hazing as their first line of defense from urban coyotes. The Project Team learned from cities that do not employ education programs that some entities that manage urban coyote populations utilize hazing due to its status as a "deliberate act of negative reinforcement" (Bonnell, 2016). Municipalities that use hazing as a primary enforcement method deploy police officers and/or animal control officers to visually and audibly utilize hazing. Others provide paintball or airsoft guns to officers who then use the guns on coyotes they encounter. Dr. Robert Timm of the University of California Hopland Research and Extension Center informed the Project Team that the use of paintball and airsoft guns on coyotes is minimally effective. Timm suggested that these methods color mark and shock the coyotes, but the coyotes can learn from these patterns to avoid areas where these tactics are employed (R.Timm, telephone interview, April 10, 2017). In fact, many researchers and industry experts shared with the Project Team that hazing is not a scientifically defensible practice, and it has little support from the academic community to suggest that the practice is an effective long-term mitigation method. Most of the experts the Project Team interviewed articulated that hazing is a short-term coyote mitigation method used to instill fear in the animals. However, most experts agreed that coyotes can learn from these strategies and alter their behaviors to avoid hazing interactions with humans. This learned behavior has been regarded by some researchers as the "Wallpaper Effect," where coyotes no longer fear humans or their hazing tactics—they simply exist next to humans as if they are wallpaper (Bonnell, 2016). A researcher also suggested that "hazing can be considered nothing more than a personal safety tool since coyotes are so adaptable" (Bonnell, 2016).

Of the municipalities the Project Team interviewed that supported the use of hazing, the Project Team learned that they call for consistent and frequent community participation for the practice to be considered successful. Certain cities that are large in size have little funding or resources to dedicate to the management of urban coyotes, so they have relied upon the use of hazing to address coyote issues in small ways. Researchers found that "when appropriate preventive actions are taken before coyotes establish feeding patterns in suburban neighborhoods, further problems can be avoided. However, this requires aggressive use of scare

devices and hazing, as well as correction of many environmental factors that have attracted coyotes into neighborhood[s]" (Timm et al., 2004, p. 55). Timm, Baker, Bennett, and Coolahan suggest that if hazing is employed before coyotes develop habituated feeding practices in suburban areas, this tactic may aid in the prevention of human-coyote interactions.

Targeted Removals

The Project Team also learned that targeted lethal removal of problem coyotes was used in some instances as a mitigation technique. This practice consists of removing and subsequently euthanizing coyotes that no longer fear humans or have attacked either a human or pet. Aggressive coyote behavior, pet bites, pet takes in close proximity of owners, and human bites have been causes for targeted lethal removals. Targeted lethal removals are considered a last resort for many of the municipalities the Project Team interviewed, but industry experts theorize that in most urban areas, coyotes have lost their fear of humans and have become bolder by the constant presence of food sources (Timm, et al., 2004). This emboldened behavior leaves urban coyote managers uneasy, as coyotes are seemingly more likely to behave in ways that can be interpreted as aggressive towards humans. During city case study interviews, certain municipalities revealed that the lethal removal of problem coyotes is an effective method to remove safety risks from their cities. Further, researchers found that in accordance with wildlife trapping and removal laws, "lethal removal of problem coyotes by use of either leghold traps or shooting has proven to be effective in solving problems when coyotes lose their fear of humans and begin to behave aggressively" (Timm & Baker, 2007). Clearly, this practice is contentious due to the euthanasia of coyotes, but some cities and researches find this method most effective as it directly eliminates problem coyotes. Representatives from Culver City stated that the city currently contacts the California Department of Fish and Wildlife to utilize the targeted lethal removal method when presented with a problem animal that incites public safety concerns. Culver City reserves targeted lethal removals as a last resort, but utilizes the method when situations are dire.

As previously stated, coyotes are very intelligent animals, and they possess the ability to learn from behaviors and their surroundings. Dr. Robert Timm, a wildlife specialist, found that in some cases when coyotes have been captured, trapped, or injured, these incidents can be communicated to other coyotes and populations surrounding the territory. Coyotes can interpret the scenario or loss of a peer from a neighboring territory, and they can comprehend capture and death. Thus, the use of targeted lethal removals decreases the habituation of coyotes in urban areas (R. Timm, telephone interview, April 10, 2017). While many cities choose not to utilize lethal targeted removals, if faced with aggressive and violent coyotes, these practices may remain as an option.

Enforcement of Wildlife Feeding

The Project Team learned through further case study interviews that cities in Southern California are attempting to use the enforcement of wildlife feeding to avoid human-coyote interactions. Interviewed municipalities stated the need for explicit consequences for individuals who partake in the feeding of coyotes and wildlife. As detailed above, feeding wild animals violates state and local laws and, nonetheless, wild animals are still being fed by humans. Dr.

Robert Timm argued that there is a need for greater enforcement of feeding regulations (R. Timm, telephone interview, April 10, 2017).

Additional interviews conducted by the Project Team revealed that currently, Culver City is in the process of enhancing wildlife feeding enforcement mechanisms, in response to residents feeding coyotes. Culver City has attempted to update City regulations regarding wildlife feeding. Even as cities consider raising the fines for individuals who feed wild animals, witnessing an individual feeding a wild animal is difficult to locate and prove. An animal control officer or a police officer would be required to observe the act of feeding, document the act, and write a citation on sight. This limitation is the reason why other municipalities do not pursue increasing fines for wildlife feeding. However, a majority of the municipalities the Project Team interviewed agreed that enhanced enforcement methods would do more benefit than harm.

Tracking

Another common practice found by the Project Team via case study interviews is the use of tracking and data collection as forms of measurement of coyote activity. Documenting the patterns and habits of urban coyotes aids urban coyote managers as they develop policies and programs that directly respond to coyote behavior. This data collection method better informs and prepares municipalities as they educate the public about urban coyotes. Interviewed cities placed emphasis on capturing as much data as possible, tracking coyote sightings and interactions in a thorough and organized manner, and inputting sighting and attack information into one central database. City case study interviews also revealed that some municipalities compile data regarding: 1) the nature of attacks, 2) time of day, 3) location, 4) aggressive behavior or stalking, and more. Some cities also expressed that they have collected data through coyote collar tracking studies. However, collar studies are claimed to be most effective when many coyotes—rather than one or two—are collared and observed over a considerable amount of time. Experts stated that when few collars are utilized, only limited data can be collected and outliers cannot be accounted for.

Cities in Southern California have also begun to utilize modern technologies to track and report coyote sightings and coyote interactions. Modern cell phones have made this ability widely accessible to the general public. Dr. Niamh Quinn has developed a cell phone application entitled *Coyote Cacher* where coyote interactions and sightings can be reported. Dr. Quinn suggested that comprehensive regional data and reporting can greatly benefit the study of urban coyotes. The Project Team was also advised that cities send e-mail blasts and mass telephone calls out to residents when problem coyotes have been identified. Some cities have enlisted the assistance of local elementary, intermediate, and high school faculty and students via their engagement in citizen science projects. Police departments and animal control officers have supported these citizen science projects by installing stop-motion cameras in culverts and washes. The data collected by these cameras has been used in the classroom to enumerate coyote sightings and interactions, while educating students about wildlife, the danger of coyotes, and need for monitoring and tracking these animals. The students' data intake was then provided to police and animal control departments as synthesized data.

Management Plans

Lastly, the Project Team heard a general call for clear urban coyote management plans for cities that experience coyote activity. Management plans establish a protocol and methodology to assess and address this issue. Not all municipalities the Project Team interviewed had an urban coyote management plan in place, but most suggested that planning documents create a streamlined approach to managing urban wildlife and reducing negative human-coyote interactions. Of the municipalities interviewed that currently have management plans, these cities suggested that clear language should be utilized in plans and consequences for those that feed wildlife should be explicitly stated through fines. It was advised that the urban coyote management plans fit the city or county ethos and are realistic in their approach. Many cities have modeled their management plans after cities that have both established plans and been proactive on the urban coyote front.

11. Assessment of Torrance Police Department's Urban Coyote Management Performance

Based on a multifaceted research strategy, the Project Team found that the Torrance Police Department has done a very thorough job thus far regarding urban coyote management and response. Torrance PD has made significant efforts to educate the community about coyotes and detail precautions residents can take through a variety of methods, including: 1) deploying a bike patrol to targeted areas where there is a high coyote presence in order to inform the public about urban coyotes and how to safely respond to coyote encounters, 2) contracting a vendor to distribute informational brochures, water bill inserts, etc. regarding how to safely coexist with urban coyotes, 3) collecting and publishing statistical data detailing coyote sightings and coyote attacks in Torrance, 4) developing an Urban Coyote Management Plan for the City of Torrance that is available for public viewing on Torrance PD's website, and much more. As shown by Torrance PD's many efforts to achieve peaceful coexistence between residents and coyotes, it is evident that Torrance PD is proactive in addressing urban coyote concerns across the city.

During the course of the research study, Torrance PD was referred to as the poster child of urban coyote management, as well as an innovative department that is not only leading the way for urban coyote management, but is also receptive to feedback. However, despite these reviews, there are steps that can be taken to increase Torrance PD's effectiveness surrounding urban coyote management, which are detailed below.

12. Recommendations

Based on the common practices and neutral assessment previously discussed, the Project Team proposes the following recommendations to Torrance PD:

1. **Enhance coyote education and outreach approach**
2. **Hire a civilian program manager**
3. **Specify and enforce wildlife feeding consequences**

Enhance Coyote Education and Outreach Approach

The first recommendation is to enhance coyote education and outreach. This recommendation arose due to the common practices witnessed in neighboring cities, as well as information gathered during expert interviews. In some cases, residents were not aware that this was an issue of concern, as they did not have a child or pet attacked by an urban coyote, nor did they witness one displaying abnormal behavior. Another issue involved lack of knowledge on how one should interact with coyotes. The advanced education of hazing and how to deter coyotes would allow individuals to be equipped appropriately when interacting with or avoiding coyotes. Expert interviews constantly reinforced the idea of education. To them, educating the public and providing resources through outreach would allow cities to be more effective in the management of urban coyotes. Regardless of the severity of the issue, being well informed can allow for preventative measures to take place that could help resolve coyote problems. Furthermore, as previously shown, human behavior is seen as an underlying factor for the perceived increase in urban coyote activity. Humans provide food sources, water, and shelter whether it be directly or indirectly. Enhanced education and outreach would allow Torrance PD to inform and connect with individuals from varying backgrounds, ethnicities, etc. The geospatial coyote map previously referenced displayed that areas with non-English speaking households exhibited low coyote sighting response rates especially when compared to the number of attacks that occurred in the area. This indicates the potential language barrier currently established by only implementing education and outreach in English. From this information, the Project Team recommends a variety of tactics. The first is to ensure that educational materials and trainings are translated and provided in multiple languages based upon the Torrance community's languages depicted in the geospatial map. Torrance PD has distributed pamphlets and trainings in English and have utilized vendors in the past that may not have been held accountable for deliveries. The Project Team's recommendation is to hire a new vendor, establish the expectations of their work, and utilize them to partake in the distribution of water bill inserts, pamphlets, and door hangers. Focusing on improving education and outreach through resources and trainings would be effective in tackling the human factor previously addressed. The final aspect of this recommendation is to create a citizen science project in which local schools are utilized to informally observe coyote behavior. This would be beneficial to both Torrance PD, as well as local residents. Torrance PD could gather additional information regarding coyote behavior while simultaneously involving the local community. This would allow for the residents to feel connected to the solution and believe they are working towards solving the problem.

Hire a Civilian Program Manager

The second recommendation is to hire a civilian program manager to oversee the coyote management program and take on additional program management responsibilities as needed by the department. While having a team is a great way to brainstorm new ideas and implement solutions, common practices and expert interviews revealed that having a staff member focused on this task would provide many benefits to the department. It would be one source of contact that Torrance residents could reach out to should they ever have concerns or questions about urban coyotes in the area. It would also streamline coyote management and would allow for

consistent information and tracking by ensuring that this individual manages the program and is not restricted by additional responsibilities. This individual could dedicate his/her time to executing and improving the Torrance Coyote Management Program.

Specify and Enforce Wildlife Feeding Consequences

The final recommendation is to enforce penalties on coyote and wildlife feeders. This recommendation arose due to the concerns from experts that highlighted the dangers associated with wildlife feeders within the community. Some experts argued that when coyotes are not hazed, they lose their fear of humans and can begin to exhibit abnormal or hyper aggressive behaviors since they no longer feel threatened. Feeders are also ensuring constant interaction with urban coyotes and influencing coyote habituation. This is extremely problematic, because interviewed experts expressed difficulty in re-hazing coyotes. Some experts said that once coyotes are habituated, they need to be captured and euthanized, as it is very difficult to reintroduce the fear of humans in them. The Project Team recommends a system of penalty and consequence that would deter individuals from feeding coyotes and other wildlife. In addition, the Project Team recommends utilizing the educational materials as a method of deterrence. This would involve including exact fines and consequences of feeding in the distributed multilingual materials, which would help educate the public. Pressure from law enforcement would also help in establishing the severity of this illegal act and assist in hindering the habituation of coyotes.

13. Implementation

The Project Team proposes that each of the aforementioned recommendations are implemented in three phases. While each phase requires a number of steps, the Project Team believes that taking these specific steps over time will yield the most success for each recommendation. The phases and steps proposed for each recommendation are detailed below.

Enhance Coyote Education and Outreach Approach

Phase #1: In order to make outreach materials and training workshops accessible to a wide population range in Torrance, one of the first steps in this phase would be to determine the languages that Torrance PD should translate its coyote informational brochures. Based on the geospatial map referenced earlier in this report, as well as Torrance's demographics, the Project Team recommends that some of these languages include: 1) Spanish, 2) Korean, and 3) Japanese. After solidifying these language choices, Torrance PD should then identify the method that would be most suitable to complete these translations. The Project Team recommends that Torrance PD either reaches out to local schools, teaching professionals, etc. for assistance or that Torrance PD reaches out to City of Torrance employees who might be able to assist in the translation process as well. Payment could be offered for these services, or Torrance PD could ask for volunteers who are native speakers of the languages chosen for educational material translation. (A new budget for education and outreach would also need to be created in this phase in order to implement these enhancements within the City's financial abilities.) Once a working relationship is established between Torrance PD and its selected translators, Torrance PD could request the help of these individuals when advertising and delivering content in its coyote education workshops.

Phase #2: After assembling educational content in additional languages, the next steps necessary to enhance Torrance PD's coyote education and outreach approach would be to 1) determine how the newly translated educational material would be dispersed to residents, 2) identify and prepare workshop content, and 3) create a schedule for the City's coyote workshop courses and determine where the workshops would be conducted. For example, in its efforts to offer coyote workshops to the public in a variety of languages, Torrance PD could conduct workshops on a bi-monthly basis in four languages (e.g. English, Spanish, Korean, and Japanese) or as needed. In order to disperse the newly translated educational material to residents, Torrance PD could contract with a new door hanger distributor to ensure that outreach materials are successfully circulated throughout the Torrance community. In the past, Torrance PD utilized a door hanger distributor to distribute 30,000 flyers to Torrance residents (J. Uyeda, telephone interview, March 20, 2017). However, complaints were received that this information had not been obtained by all members of the community. As a result, 36,000 water bill inserts with coyote information were delivered to the public (J. Uyeda, telephone interview, March 20, 2017). In order to avoid the need for and costs of a secondary water bill door hanger campaign, Torrance PD could conduct a door hanger company bidding process and/or contest that would require a verification of delivery element by the selected company. This verification of delivery element would call for proof that residents received the newest coyote education materials. As an alternative option to printing brochures in multiple languages, URL addresses could be placed in current outreach materials for individuals to visit and obtain the presented information. Translated outreach materials could also be placed on Torrance PD's website to avoid the costs associated with printing additional outreach materials.

Phase #3: In the final phase of enhancing Torrance PD's coyote education and outreach approach, Torrance PD could engage volunteers and the public through a citizen science project by partnering with local elementary, middle, and high schools and by requesting their assistance in documenting coyote activity observations or becoming coyote educators themselves. Torrance PD could reach out to the Torrance Unified School District or the individual schools within the district about the project and specify the duration of their requested involvement, as well as the extent of their requested assistance. While public participation may not be as high as desired initially, this would be an effort that would allow the public to take ownership of the urban coyote issue within the city on a community level.

Hire a Civilian Program Manager

Phase #1: In order to internally expand Torrance PD's Urban Coyote Management Team and assign one individual focused on the team's increasing urban coyote workload, Torrance PD could begin by compiling a list of responsibilities the department envisions for a new civilian program manager. This would be a full-time program manager position that would help alleviate the current urban coyote management responsibilities given to various officers within Torrance PD. Also, this role could be tasked with responding to additional issues of Torrance PD concern when necessary.

When determining the functions of the position, as well as the appropriate funds to allocate to the new role, a duty/salary survey of similar positions in other municipalities in the

state and/or region could be conducted. Torrance PD could submit a request to the City of Torrance Human Resources Department to perform said research. Not only would this provide more information about possible responsibilities to include under the position's description, but it would also help the City develop a suitable salary/benefit range for the new role that is within Torrance PD's financial abilities. After this research has been completed, Torrance PD and the City of Torrance Human Resources Department could develop a proposal for the position, which would include the position's description and the candidate qualifications desired.

Phase #2: Once a position proposal is created, Torrance PD would need City Manager approval for the new role. After the role is approved by the City Manager, Torrance PD would need approval from the City's Finance Department for the position and subsequent approval from the City's Budget Review Team after submitting a Program Modification Request. Once these stages are passed, the position would require City Council approval. If the role is deemed a "civil service" position instead of an "at-will" position, the role would then require the conceptual approval of the City's Civil Service Commission. Next, the position would need the approval of the City Council once more for financial purposes, as well as the City's Civil Service Commission. The entire approval process can be lengthy, so it is important for a Human Resources request to be initiated by Torrance PD as soon as possible.

Phase #3: After all of the aforementioned information is compiled and the necessary approvals are received, Torrance PD would be able to outline the examination process for the position. The City of Torrance Human Resources Department could then help Torrance PD advertise the position and facilitate the hiring process of the program manager.

Specify and Enforce Wildlife Feeding Consequences

Phase #1: Effective implementation of this final recommendation would include the initial steps of clearly specifying the legal consequences for feeding wildlife in the City of Torrance Coyote Management Plan. In order to emphasize the severity of such actions, additional information could also be provided in the City of Torrance Urban Coyote Management Plan that details the negative effects that feeding wildlife can have on wildlife itself. Torrance PD's Urban Coyote Management Team could convene to write out these consequences (i.e., monetary, etc.) in accordance with state, county, and city laws.

Phase #2: After the wildlife feeding consequences are written out, Torrance PD would need City approval before publishing the updated Urban Coyote Management Plan. Once approval is received, Torrance PD could publish the updated plan, announce the adjustments at the next Torrance City Council meeting, and add the additional information to its education materials and coyote workshops.

Phase #3: In the final phase of the implementation process, a department-wide enforcement strategy could be designed and executed by Torrance PD's Urban Coyote Management Team. This strategy could incorporate multiple elements, including the allotment of the appropriate number of Torrance PD officers—as well as the coyote program management professional (once hired)—to enforce said consequences.

Potential Limitations

Any citywide implementation process can experience limitations. Whether through monetary restrictions, City procedural restrictions (both governing and temporal), or department personnel enforcement capacity restrictions, there are hurdles that Torrance PD may come across. The Torrance community may even present restrictions in the forms of public pushback or lack of public participation when asked to assist during the aforementioned implementation phases. However, if Torrance PD remains transparent about the goals and intentions of the Urban Coyote Management Program and exercises due diligence to provide services that promote the peaceful coexistence between humans and coyotes, the research team believes that Torrance PD will continue to be successful in its management efforts.

14. Future Consideration

After careful evaluation of Torrance PD's efforts regarding urban coyote management, the Project Team proposes the following future consideration:

Regional Urban Coyote Management Approach

As previously discussed in this report, concerns surrounding urban coyote activity are occurring not only in Torrance, CA, but also throughout Southern California. While every municipality can develop its own approach to urban coyote management in accordance with California wildlife laws, the Project Team foresees that this issue will require a regional approach and a regional management plan. This regional approach would warrant coordination between municipalities, agencies, and more in order to reach true effectiveness. It would also be important for organizations to engage in advanced planning and avoid "crisis du jour" (Hartman, 2016). If organizations could come together across Southern California to develop a proactive, long-term regional plan for coyote management, transient coyote issues in the region could be addressed. As mentioned earlier in this report, coyotes do not always remain in one particular area over time. Rather, coyotes tend to migrate depending on available resources and environmental conditions. Therefore, it is important for not only the City of Torrance, but also organizations across Southern California to work together on urban coyote issues in order to achieve long-term management sustainability.

15. Future Areas for Research

Beyond the future consideration discussed above, the Project Team suggests the following future areas of research in order to further the knowledge of urban coyotes not only in Torrance, CA, but also in Southern California as a whole:

Urban Coyote Tracking Study

The Project Team proposes that the Torrance PD proceeds with its initial plan to conduct an urban coyote collar tracking study in Torrance. This study could be designed similar to the LA Urban Coyote Project in order to track coyote patterns within city boundaries. However, adjustments could be made to the LA Urban Coyote Project's design for long-term data

collection. For example, the LA Urban Coyote Project lost some of its collars due to premature malfunctions (J. Brown & S. Riley, telephone interview, April 6, 2017). According to multiple coyote tracking experts, the larger the quantity of information being collected, the shorter duration of a collar's life. While making improvements to the collar's data collection duration is important, these improvements can be expensive. Therefore, the Project Team suggests that additional finances be allotted to this study in order to utilize collars that could sustain long-term data collection. Furthermore, in accordance with adopting a regional approach to coyote management, the Project Team proposes that more Southern California cities participate in this tracking research. The Project Team heard multiple comments over the study's duration about how few scientific questions can be answered on a regional level with only two collars in one city. Rather, it would be more beneficial if multiple cities participated in the tracking study and efforts were combined to increase the study's sample size and to see if any tracking patterns could be observed on a regional level. Once completed, the results of the study could be released to the public in order to have a more advanced understanding of coyote activity in Southern California.

Urban Coyote Diet/Scat Study

Beyond a regional urban coyote tracking study, the Project Team suggests that additional research be conducted regarding urban coyote diets. As stated earlier in this report, it is very important for humans to understand what drives urban coyote diets. In doing so, humans could make targeted adjustments to de-urbanize coyote diets and further reduce coyote attractants in urban areas. For example, the LA Urban Coyote Project is advancing research in this area by conducting a diet/scat study of coyotes in Los Angeles, CA. The study has found a multitude of substances in coyote scats thus far, including squirrels, rabbits, seeds, fruits, cats, dogs, non-digestible items, and more (J. Brown & S. Riley, telephone interview, April 6, 2017). With this type of information—especially collected on a regional scale—the public could become more informed about the adjustments needed to control urban coyote access to certain food sources, and more importantly, the adjustments needed to reduce pet-coyote conflicts and human-coyote conflicts in Southern California's urban areas.

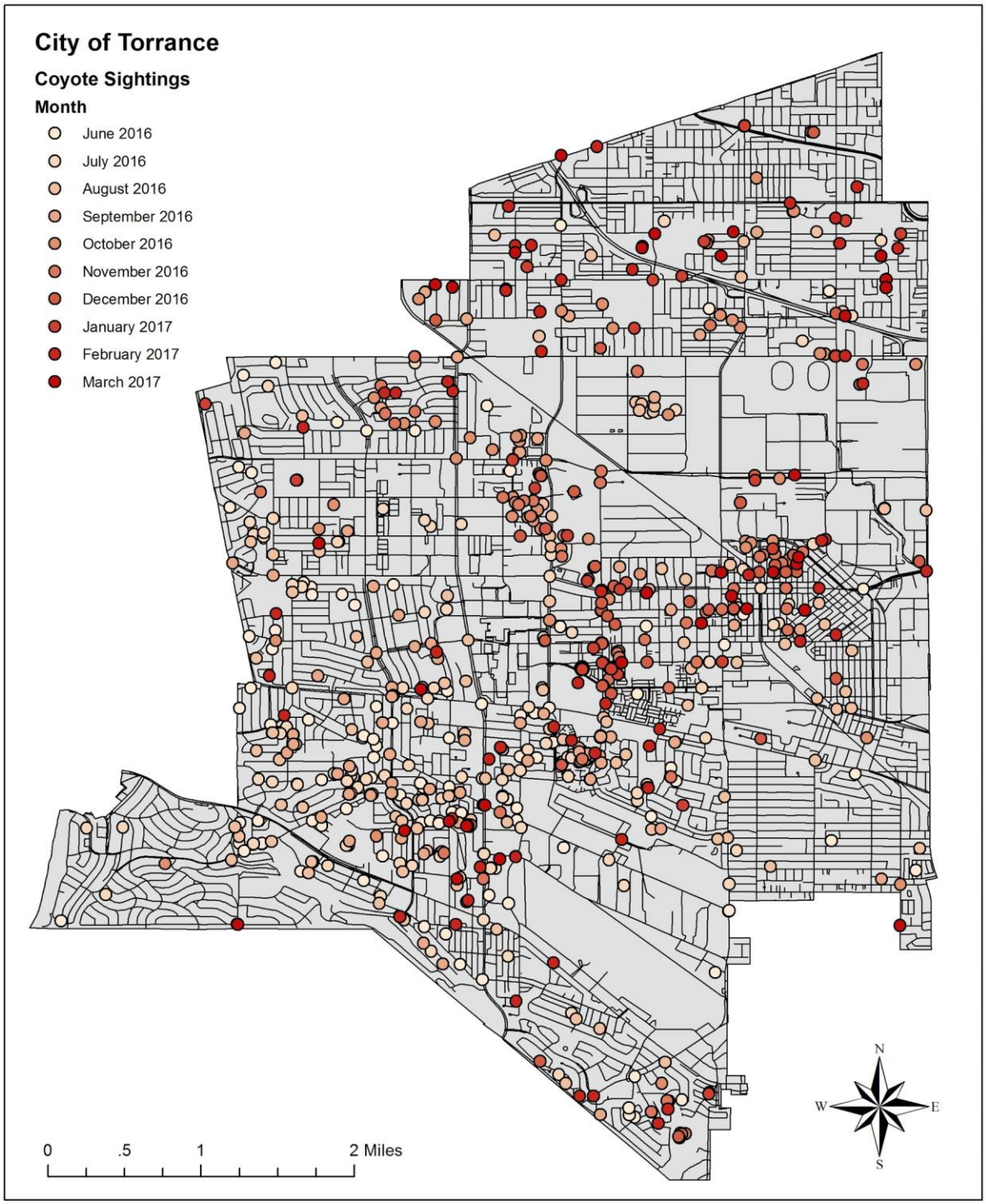
16. Conclusion

Over the course of the Project Team's research, many observations were made regarding coyote activity in Torrance, CA and Southern California as a whole. Due to the knowledge acquired from an extensive academic literature review, numerous interviews with wildlife and academic experts, various city case studies that evaluated urban coyote management procedures and policies in Southern California, and the detailed examination of internal Torrance PD coyote data through geospatial analytical strategies, the Project Team identified multiple factors that have influenced coyote activity in Torrance, CA, as well as common practices utilized to effectively address coyote activity in urban areas. While Torrance PD has been active in its approach to urban coyote management and response, the Project Team proposed three recommendations and subsequent implementation processes that the department could adopt to increase its overall effectiveness surrounding urban coyote management. By enhancing coyote education and outreach, hiring a civilian program manager, and specifying and enforcing consequences for feeding wildlife, the Project Team believes that Torrance PD will be able to

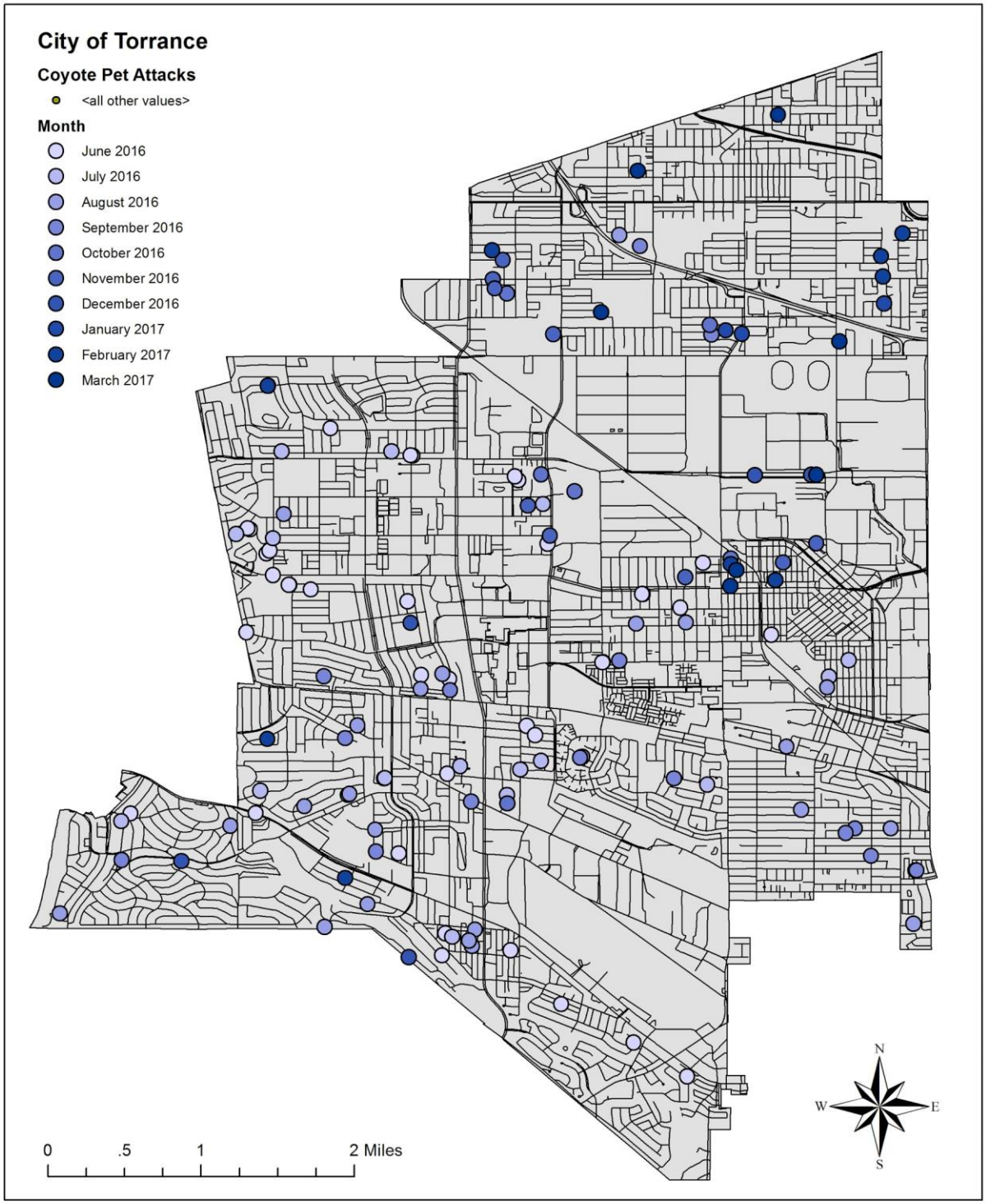
better serve the Torrance community and better address urban coyote issues in the city. Ultimately, coyotes exist in urban areas and will continue to exist near humans and their pets. Therefore, the Project Team believes that it is essential for Torrance PD to take further steps in its urban coyote management approach in order to promote and ultimately sustain safe coexistence between humans and coyotes both now and in the future.

Appendices

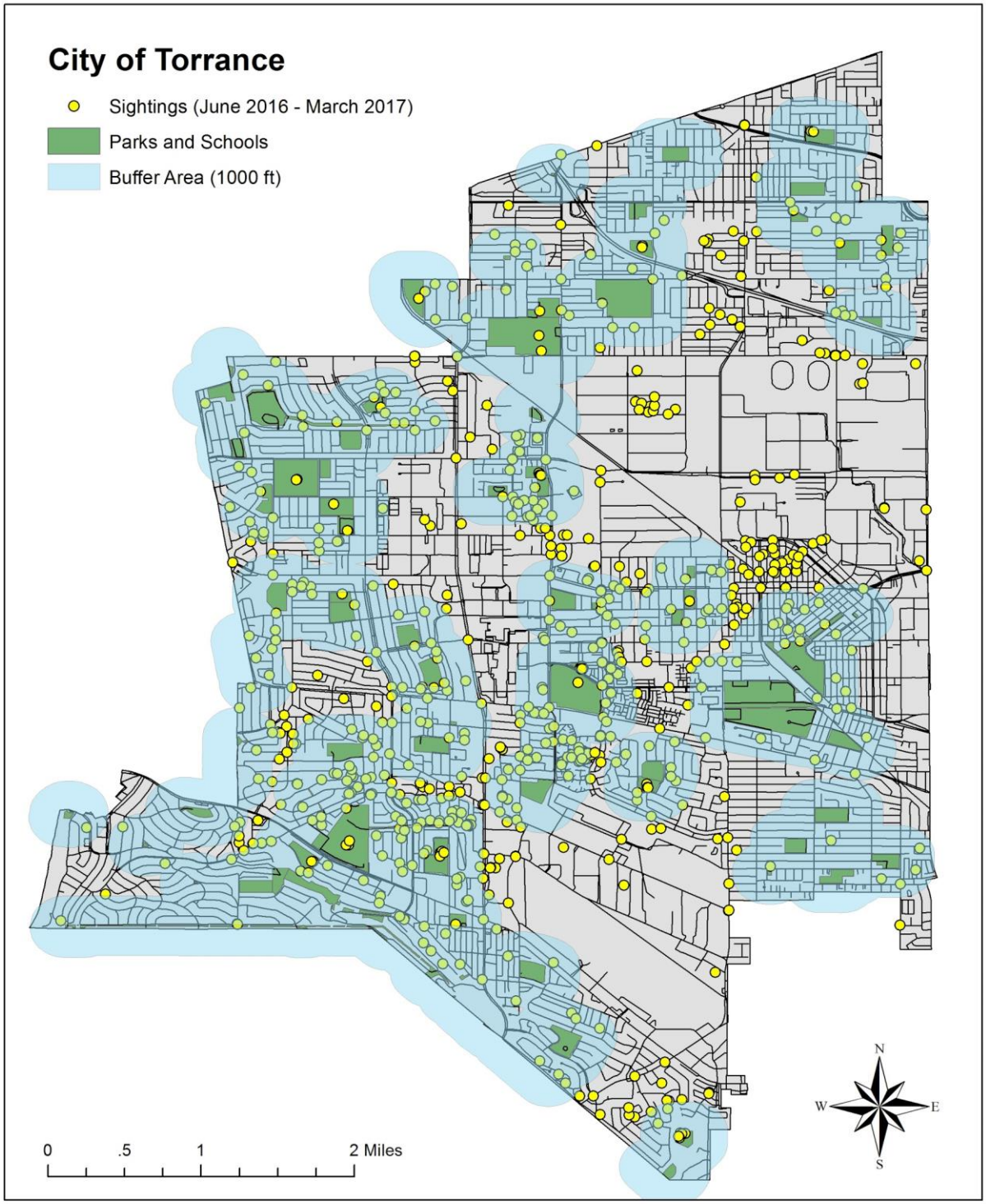
Appendix A (Coyote Sighting Trend)



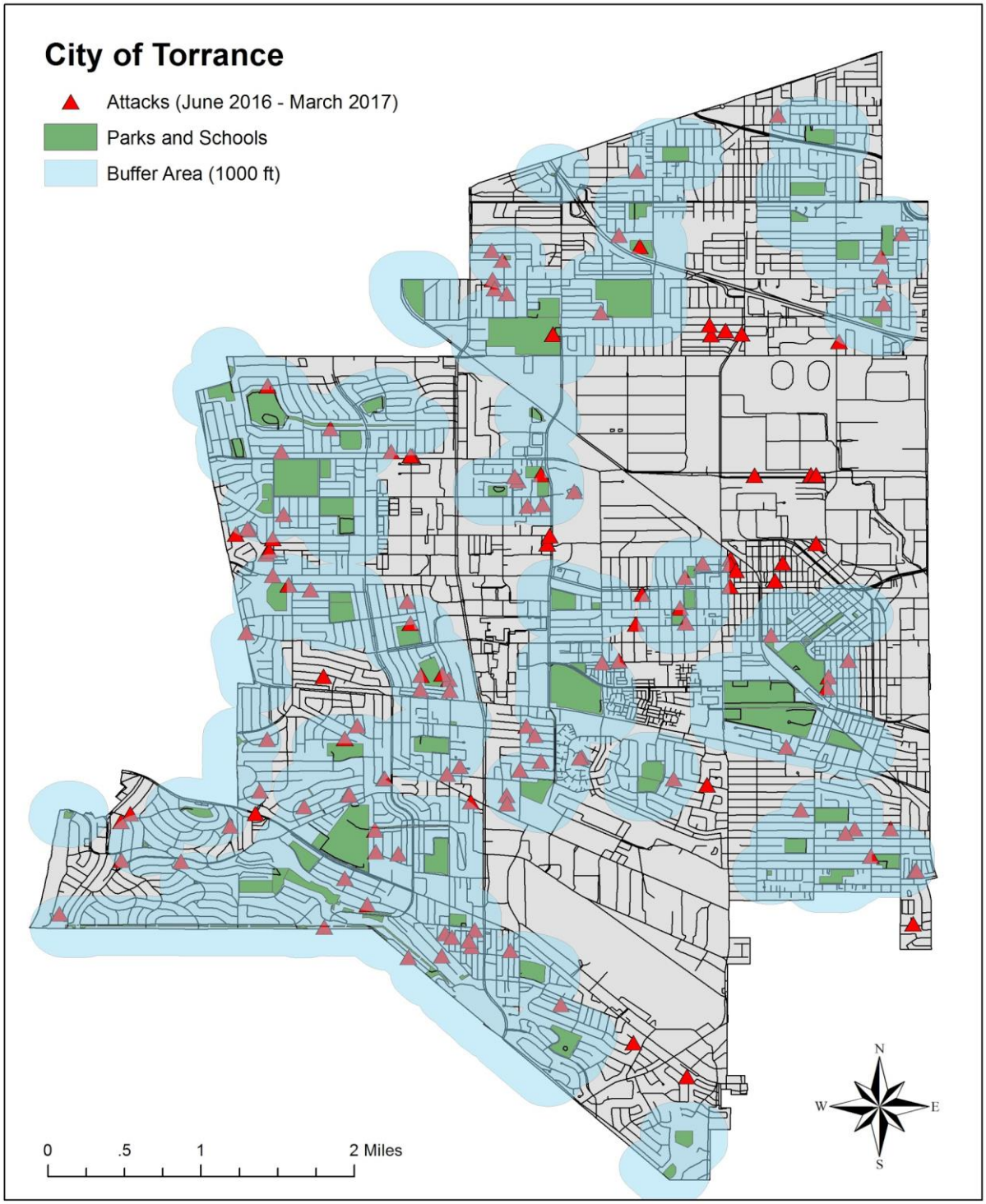
Appendix B (Coyote Pet Attack Trend)



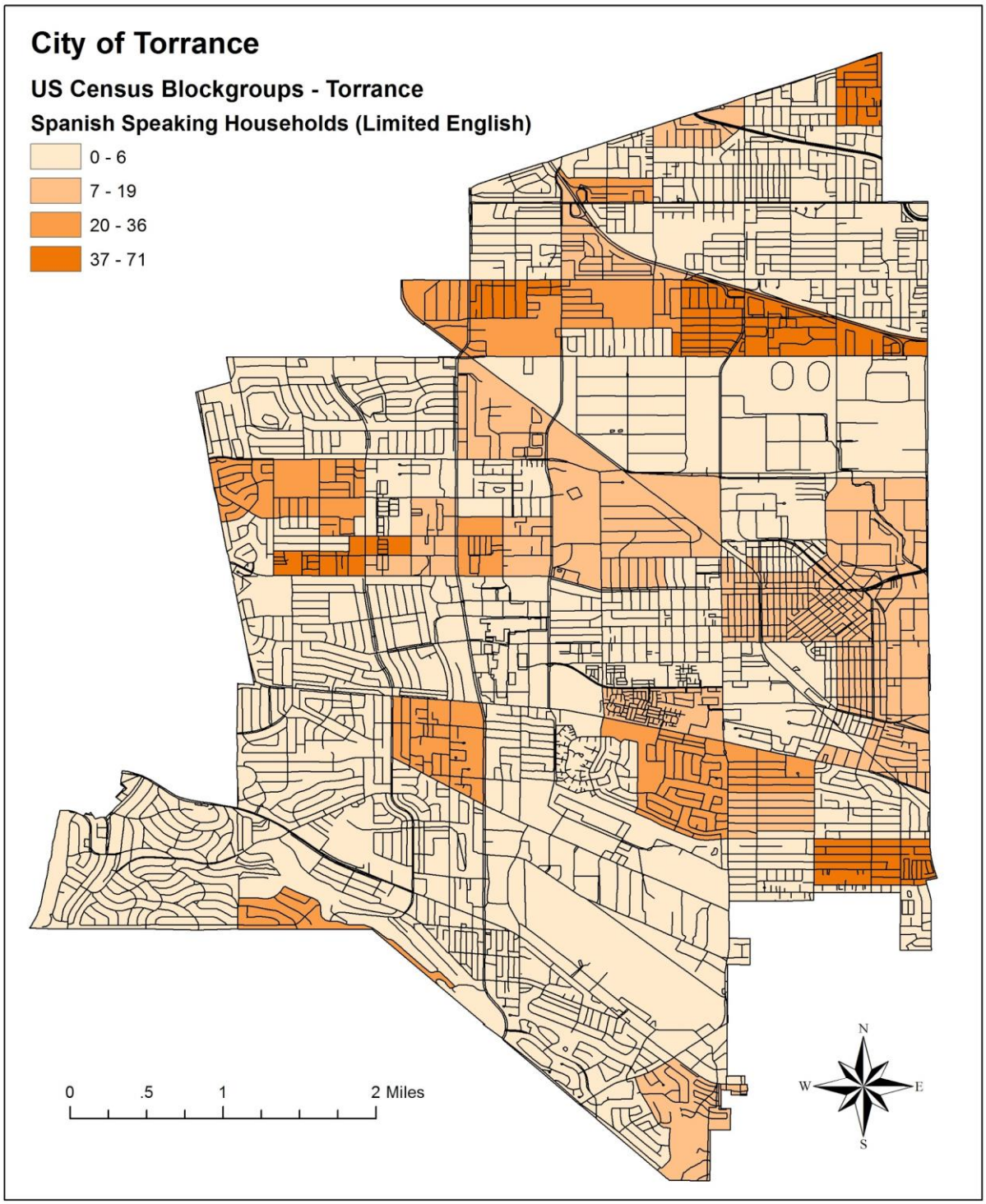
Appendix C (Coyote Sightings - Buffer Analysis)



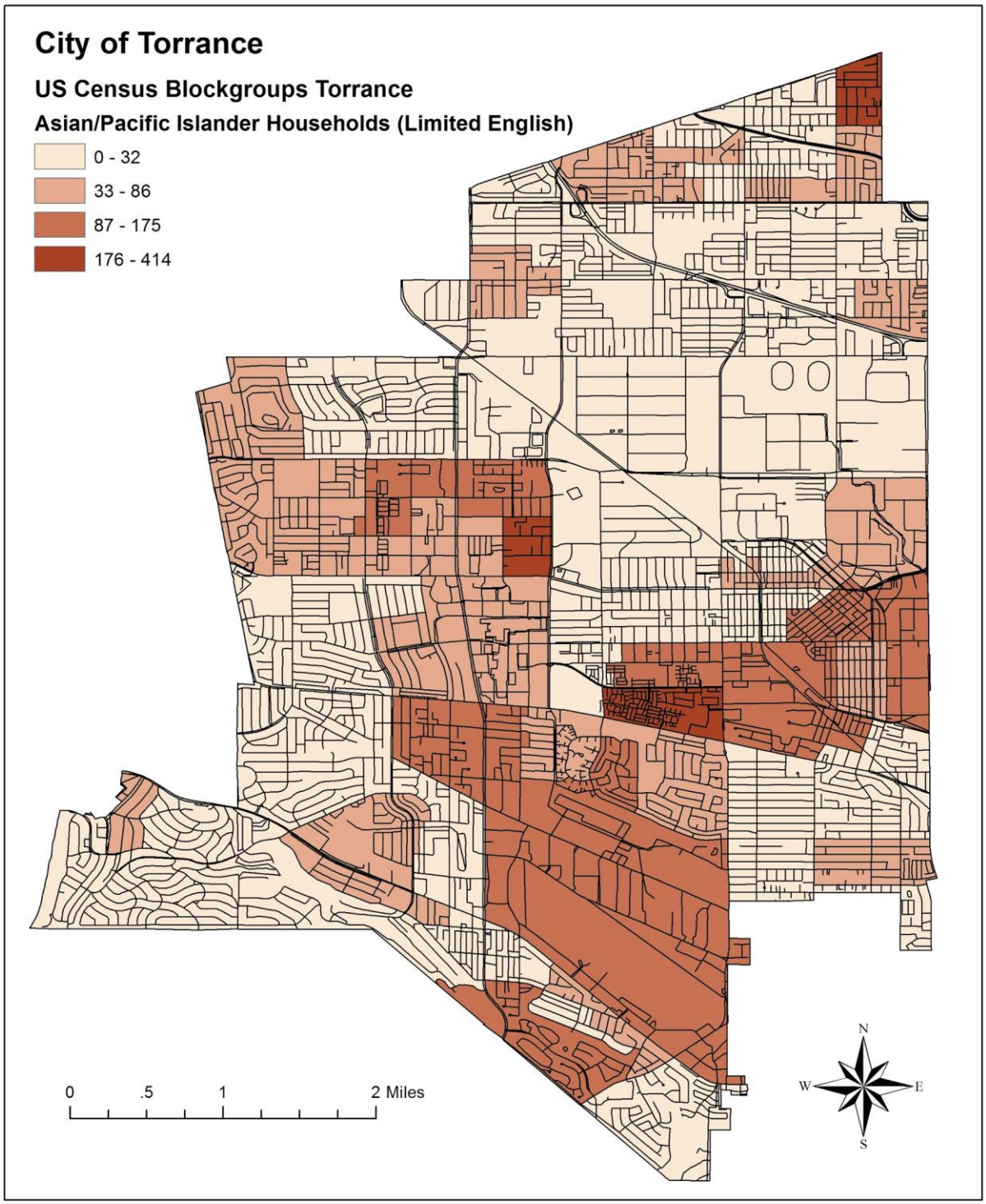
Appendix D (Coyote Attacks - Buffer Analysis)



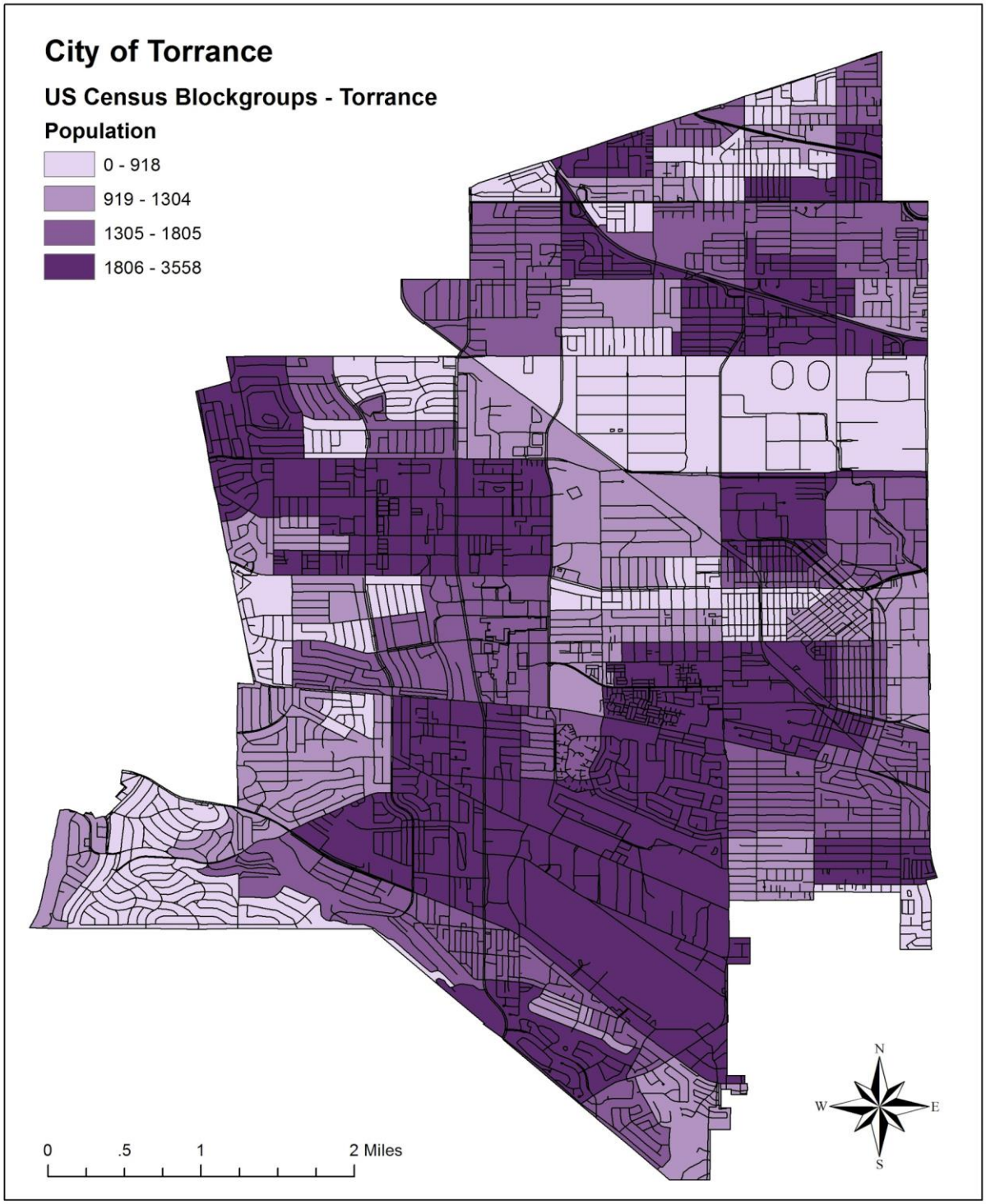
Appendix E (Demographics - Spanish Language)



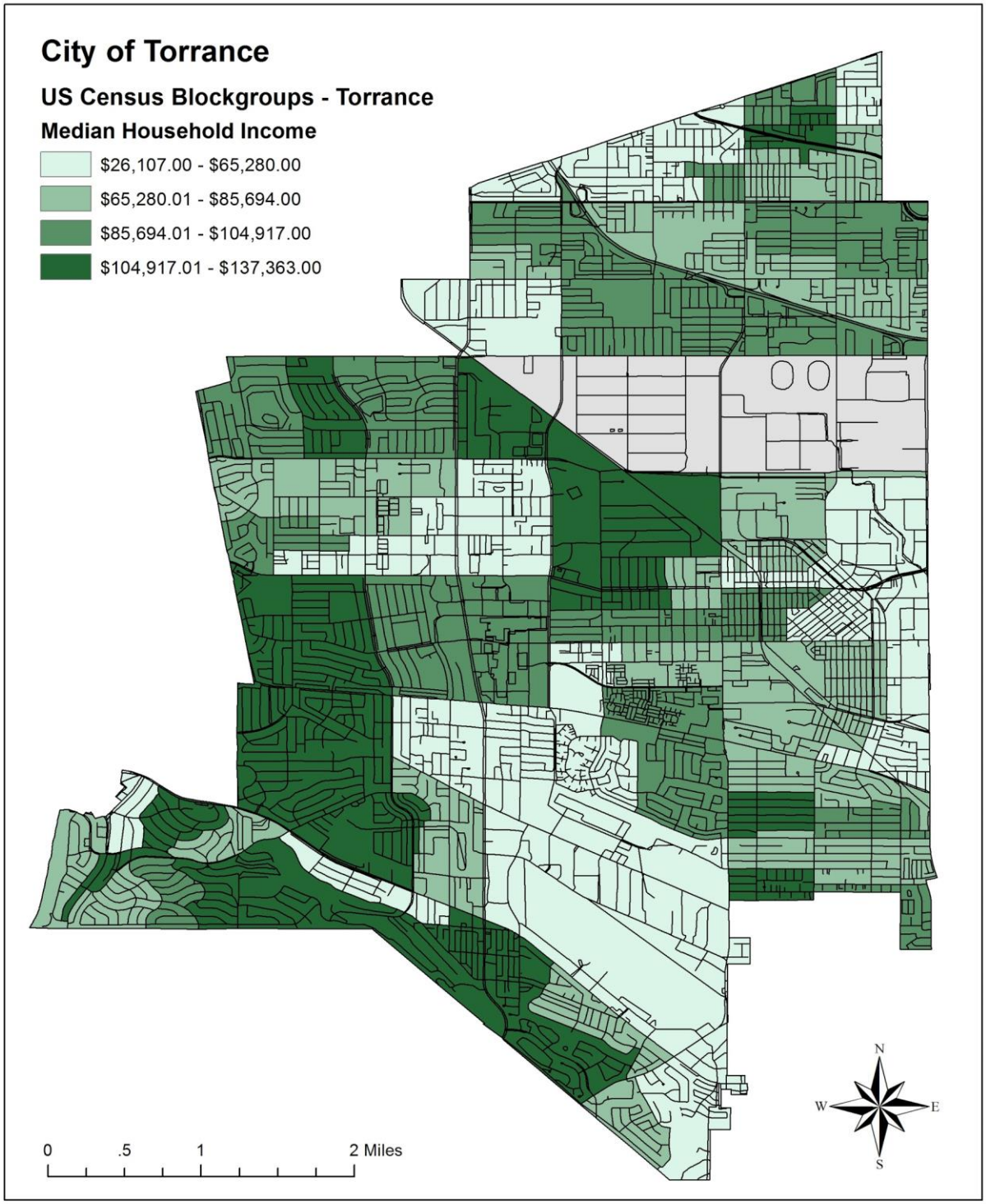
Appendix F (Demographics - API Language)



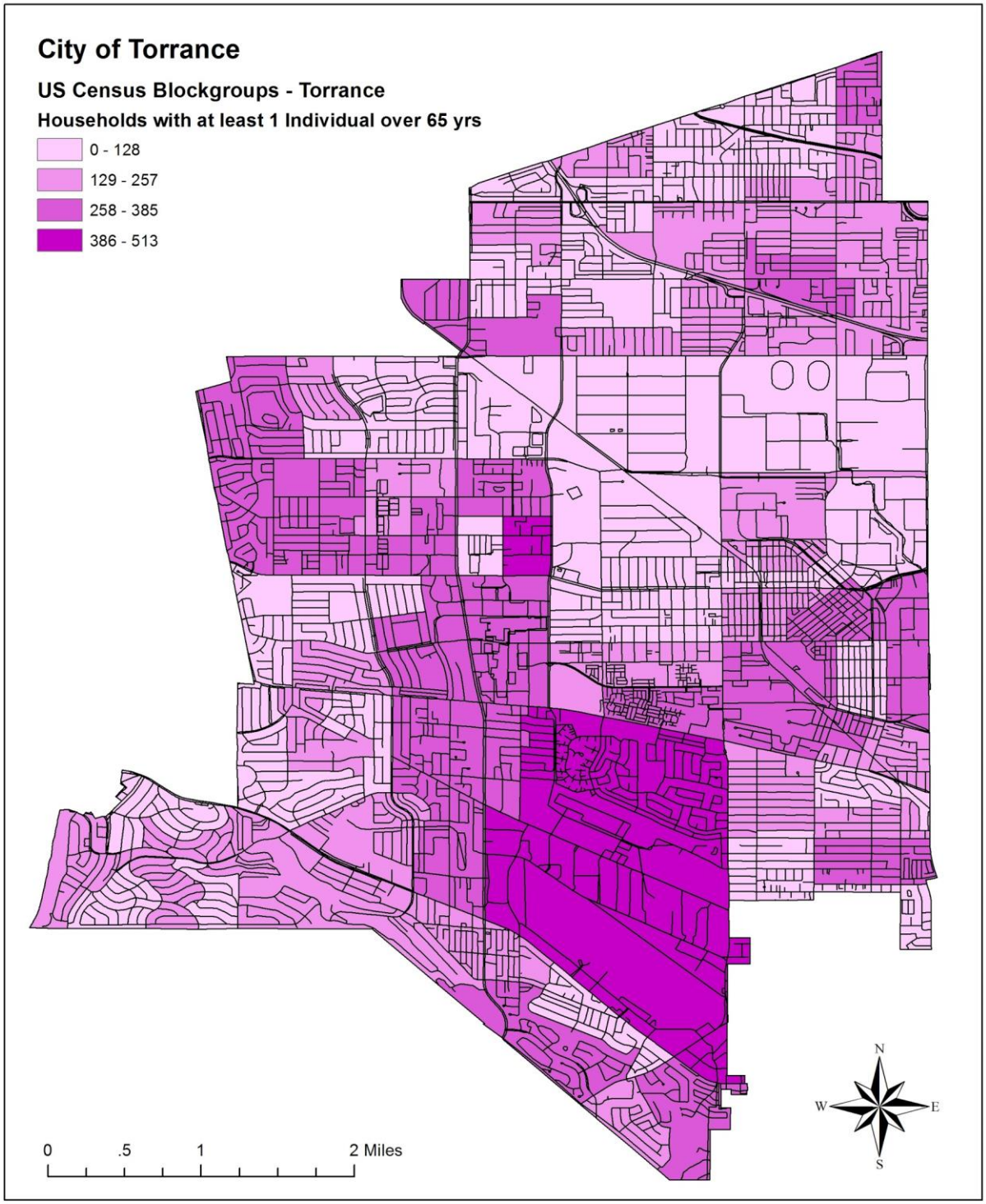
Appendix G (Demographics - Population)



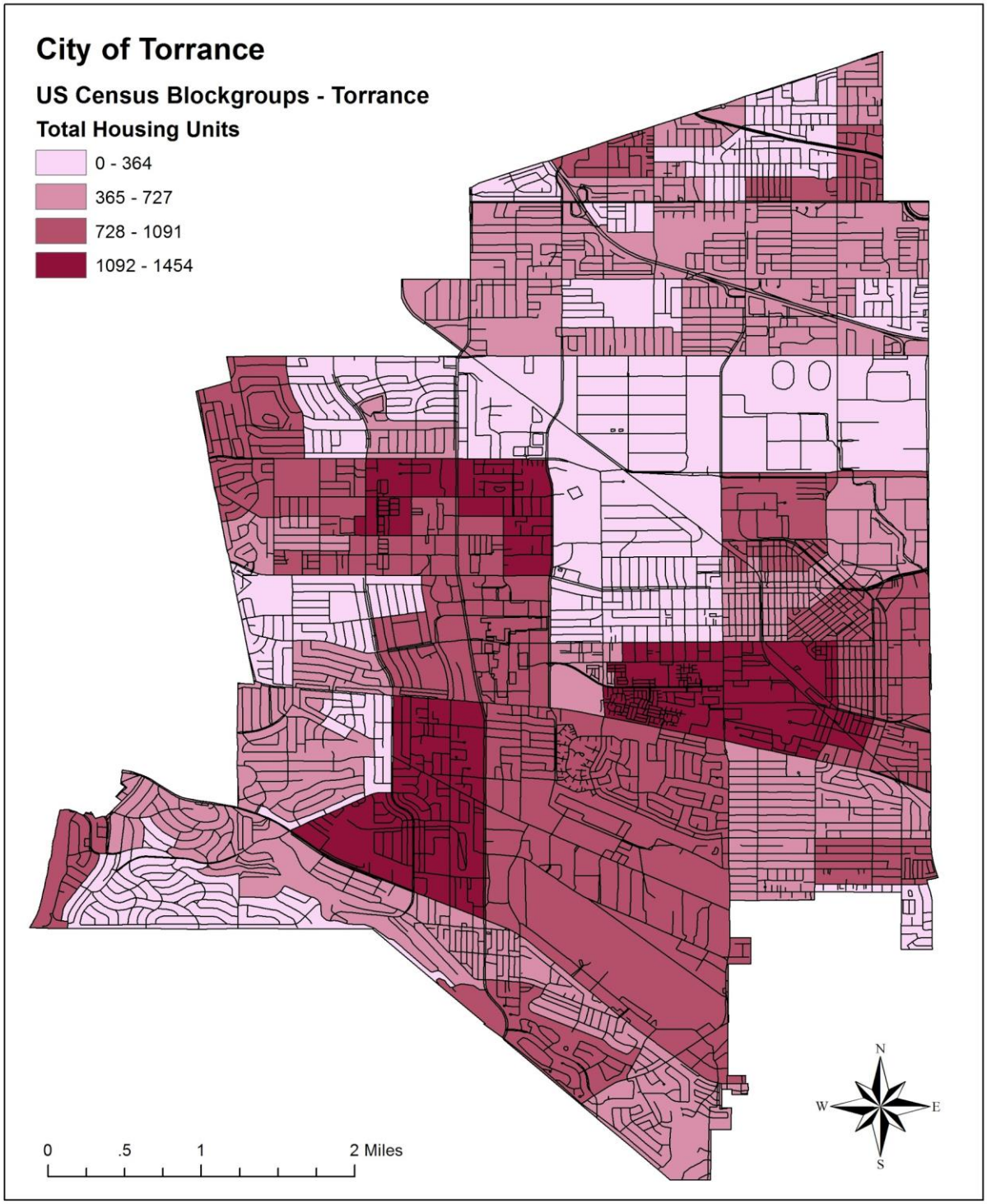
Appendix H (Demographics - Median Household Income)



Appendix I (Demographics - Elderly)



Appendix J (Demographics - Housing Unit Density)



Appendix K

City Case Study Interview Questions (Template)

- **State research purpose and research question.**

1. Has your City experienced a spike in urban coyote activity? What factors do you believe have caused an increase in urban coyote activity? Do you think climate change or the past drought has affected coyotes in Southern California?

2. Do you think construction projects have affected and/or displaced coyotes in your city? If so, how? (Or have construction projects attracted coyotes by providing them with areas for shelter? Has your city witnessed any evidence of this?)

3. Does your city have a documented Coyote Management Plan? If so, what current coyote management policies and procedures have been established?

4. Which department/agency manages urban coyote issues in your city? Do you have inter-departmental staff/a team to monitor coyote issues in your city?

5. We understand that a coyote bit a human in your city in the past. What is/was your coyote mitigation strategy prior to the biting incident? What was the response by your agency/city?

6. What other agencies or individuals have you been in contact with regarding coyote behavior and hazing techniques?

7. In your experience, what practices have effectively addressed increases in coyote activity levels in your city? Do you think these practices can be applied at a regional level? What do you think is the most effective way for humans to respond to human-coyote encounters? (Both short-term and long-term approaches.)

8. Has your city been active with community outreach/education regarding urban coyotes and urban coyote management? If so, what types of outreach has your city conducted? Have residents been receptive to this information? Have residents implemented any of the techniques they have been taught in their daily lives? (Have these techniques been successful?)

9. What would you consider success for coyote management (i.e., coexistence, elimination, community satisfaction, or something else)?

10. Are you familiar with Torrance PD's Urban Coyote Management Plan? Do you believe their plan/mitigation tactics have been successful? How would you rate the Torrance Police Department's performance regarding urban coyote management? (1-10 scale)

11. Are there any resources (e.g. journal articles, experts, etc.) that you recommend we look into/speak with for further information on urban coyotes and urban coyote management in Southern California?

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